MADRAS JOURNAL

OF

LITERATURE AND SCIENCE.

NO. 4.—NEW SERIES.

July—September, 1857.

VII. *On the Relationship existing between the Animal and Plant. By* GEORGE BIDIE, M. B., *Assistant Surgeon, Madras.*

Between the animal and plant of the higher orders there is such an apparent difference of conformation, such a contrariety of habits, that the mere casual observer will fail to recognise those secret links, by which nature binds all her works into one harmonious whole. In whatever direction however the contemplations of the naturalist tend, from race to race or from kingdom to kingdom, he discovers no rude gaps but a beautiful unison, for *nihil per saltum* is one of the great laws of creation. If we descend the scale of nature, reaching the extreme boundaries, the lowest forms, of the animal and vegetable kingdoms, we find members of these great divisions approximating so closely, that it becomes a matter of difficulty to draw any line of demarcation. The limits here are also hazy, because so far beyond the ken of unaided vision, and although the microscope has unveiled nature's secrets, disclosing a new world grand in the plenitude of its minutiæ, still its scientific eye is finite failing at times to decide which is the animal, and which the plant. It has been said that " stones grow, vegetables grow and live, and animals grow, live and feel," but this axiom is not sufficiently extensive in the terms of its definition. Thus plants in some instances seem capable of distinguishing between light and darkness, for

many only open their leaves or flowers to the sunshine, while others the *plantæ tristes*, the watchmen of the flower garden, only spread abroad their beauties to the night. Other plants exhibit a certain amount of irritability, or sensitive qualities, under mechanical or chemical stimuli. The *Drosera* and *Dionæa* woo the unwary fly to its destruction shutting it up in deadly folds, while the *Mimosa sensitiva* and a few others will shrink from the most delicate touch, and may be laid asleep, during any severe operation of the gardener, under the influence of opium or Chloroform. If on the other hand we assume as the characteristic of the animal, its capability of changing its position, we still find similar properties in the plant; for vegetable organisms are in some instances capable of changing their position and performing other movements. Thus the Zoospores of Cryptogamic plants are locomotive, and the *Desmodium gyrans* is possessed with a restless activity, its lateral leaflets dancing a perpetual measure to the music of the air. As we compare then these indications of sensibility, and these locomotive powers in the vegetable with the humbler endowments of such an animal as the sponge, which remains through life chained to one little spot of rock, giving out no indications of sensibility, we must at once be struck with the difficulties attending a true distinction, and the intimate relation that exists between the two kingdoms in question. True, we cannot instance the automatic performances of the vegetable as identical with the similar endowments of animal life, but still they indicate a sympathy, a harmony existing between the two organizations, and show us how closely the great principles of animal and vegetable life converge. Indeed, as they approach the common centre, the little cell that is the habitation of both, it is perhaps impossible to say, *here begins animal and there vegetable life.** These, here in their infancy, are subtle essences far beyond our conception, and the naturalist, as he gathers this new world together on the field of his microscope, can only *judge* and *name*, after long and patient study of conformation and habits.

Thus far we have dealt in generalities, let us now therefore exa-

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* This animal and vegetable affinity is very amusingly discussed at p. 448 of the April No. of the Dublin University Magazine 1857.—ED.

mine more closely the consanguinity of the two kingdoms, beginning with the birth of the members of both in a simple cell, and then considering what important parts cellular structures play throughout all the economy of their future life. Buffon on beholding the smallest animal of the existence of which we are aware, the little monad that swarms in stagnant water, imagined that all vegetable and animals were built up of these minute cells. True to its unchanging philosophy, which laughs at every new truth, the world sneered at Buffon's improbable idea; but we know now that the sage naturalist saw truth in his dreams. The smallest of the Infusoria, the most minute Cryptogam are but simple cells living an independent isolated life, and every living structure however complex, however strange, has had a cellular origin, and is indebted for its growth and maintenance to the modification and development of cells.* The cell consists of an enveloping membrane or cell wall, that encloses a peculiar fluid and nucleus or cell-germ. True we find numerous examples of cells that do not exhibit even the trace of a nucleus, but from these it may either have been removed by absorption, or it may be destined to appear at some future era of their existence. The modes of Cytogenesis are various, but nearly all agree in being common to the animal and vegetable. To the older Physiologists the subject of reproduction was fertile in speculation and romance, and it was only when the theory of cells and their development became known, that we were able to read its history in the earlier and more mysterious stages. In the higher animals and plants, the process is complicated in accordance with the general plan of organization, but as we approach the simple infusorial animal or cryptogamic plant, we can with facility explore the plan of nature's grand secret. Here new generations originate in accordance with the laws of Cytogenesis, the nucleus of the parent preparing a future race, or some of the other systems obtaining by which the old cell begets the new.

Remembering then that Cytogenesis is in all cases the necessary part of the process of reproduction, if from the generation of the lower species we proceed upwards to the more perfect animal or plant, we shall find that any complication of plan is merely sup-

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* The exceptions to this general rule do not demand special notice.

plementary for the nurture and development of a superior embryo. It is unnecessary to compare the various structures that are met with in the two kingdoms, as the results of the transformation of cells. In both we find tubular tissues formed by the coalescence of cells, sclerous tissues where the cells have been solidified by internal deposit, and in Ascidian Mollusca a considerable quantity of cellulose, the substance proper of plants. Indeed one observer relates, that cellulose can be detected by chemical reagents in the corpora amylacea of the human brain; and if we can therefore credit Virchow, the appellation "timber headed" will after all have a foundation in truth.

We now come to consider some of the functions of organic life, premising that in all organs where these vital operations are carried on, we find a true cellular structure retained. Beginning with absorption and assimilation, we find these processes varying, according to the rank of the animal or plant, in the respective kingdoms, but still agreeing in the constant cellular agency. Amongst individuals of humble status, the nutritious matter is at once received through the cell wall by the process of endesmose, to be elaborated and applied in the cavity of the cell to the various wants of the structure. This of all methods is the most simple, and a key to the plans of absorption and assimilation in the higher divisions, inasmuch as any apparatus more intricate is merely superadded for the production of a more elaborate nutritious fluid, and its transfer to distant parts of the organism. In the Vertebrata absorption and assimilation obtain in their most perfect state, as we find in this group a distinct tubular system, solely concerned in the manufacture and translation of the chyle or alimentary fluid. Between this and the simple endesmose and assimilation of the animalcule, there are many intervening gradations of process, and as an example of an animal occupying an intermediate position between the two extremes, we shall briefly contemplate the internal economy of an Annelide, the *Hirudo medicinalis*. In this creature, nearly the whole of the visceral cavity is filled by the stomach, which consists of an elongated tube with a number of lateral sacs. Over these cæcal appendages is spread a delicate net-work of the terminal branches of the circulatory system, destined to receive by

endesmose the elements of nutrition, which thus pass in their crude state into the general circulation, where they are elaborated and fitted for their future destiny. In the vertebrate animal, the lacteals already referred to terminate by looped extremities amongst a number of cells and nuclei; and during the passage of chyme along the intestine these nuclei become developed into cells, and the cells are busy at work selecting, absorbing and elaborating, and then yielding up their contents to the loops of the lacteals. In plants the root is the great organ of absorption, whether suspended in air, floating in water or buried in the earth. The root consists of a cellular epidermis, and internal structure of vascular bundles and cells. Here then cells are still the great organs of absorption, and if we trace the sap upwards through the alburnum and leaves, and its return through the lactiferous vessels and cells of the bark, we shall find them not less active and essential in the process of assimilation. If we now review the function of respiration in the animal and plant, we shall find that although by this process the animal eliminates carbon and consumes oxygen, while the plant fixes the former and gives off the latter, being thus so far opposed in object, they nevertheless agree inasmuch as respiration is carried on in both kingdoms, by means of organs of a cellular structure. In both too the ultimate objects of the function are the alteration and refinement of the circulating or nutritious fluid, the blood in the one and the sap in the other being fitted for the production of new or repair of old tissues, and for keeping up a supply of the various secretions. Respiration is therefore a depuratory process, and perhaps the least vital of any of the functions of organic life, many of the changes it effects being merely the results of a chemical action. We come now to speak of secretion, which is carried on by means of certain cellular organs called glands. These appropriate each a definite nature of material from the circulating fluid, as it passes along fertilized by the results of absorption and assimilation. Besides their nutritious elements however, the blood and sap contain unorganizable substances the effete products of tear and wear, which are separated to be excreted by glands differing in no important particulars from those already mentioned. The individual cells concerned in the manufacture of

the various secretions, as they disclose no appreciable disparity in structure to account for the dissimilarity of their products, must therefore possess some special endowment or quality, whereby they are enabled to make a selection of material. The mode in which the gland as a whole is constructed can have no direct influence in this respect, for secretions are vicarious, and the same gland assumes different forms in different grades of the animal kingdom. We have not space to compare the secretions of the two kingdoms, and would merely insist on the similarity of secreting structures in both, and the mysterious faculty that these possess of selecting certain substances, and only these during health, from the circulating fluid.

Thus through all the functions of organic life, there exists between the animal and plant a wonderful consanguinity. In both we find a variety of processes instituted with a view to the same results, and performed by means of structures identical in the plan of their conformation. There are still however other relations, equally strange, existing between the two kingdoms; and these are perhaps more directly practical in their bearings than those already noticed. The great Creator of the universe, has established a fixed Geographical distribution of the varieties of the animal and plant, that cannot be departed from without incurring the risk of disease or even death. The Esquimaux enjoys perfect health, living in his snow-hut and feeding upon raw flesh, the supply of which is far from regular or abundant; a mode of life that would, to say the least of it, be dangerous to any native of a temperate climate, and death to any member of an intertropical race. On the same inhospitable shores of the frigid zone, we find a scanty flora of Saxifragaceæ, Salices and Cochleariæ, not one of which has ever been removed to a milder climate with impunity. Still more impossible would it be to transplant and to adorn with our Magnolias, Camellieæ or Palmæ, the ice-bound coasts of Labrador or Greenland; or to exchange for the Lion and Tiger of the one region, the fiercer and more powerful White Bear of the other.

Early in the summer of 1852, a dog and bitch only a few months old were picked up by me on the shores of Melville Bay in about 75° N. Latitude. Both were in good health so long as we remain-

ed in high latitudes, but on the homeward voyage as we approached the Orkney Islands, in the month of cold November, both animals became sick, suffering from *fits*. The dog died of congestion of the brain, just as we sighted land, and towards the close of the following spring the bitch, which was then in the Highlands of Scotland, died I believe from the same cause. We have little reason to doubt that in both these cases, elevation of temperature was the exciting cause of disease. Of several varieties of hardy garden seeds imported from England in tin cases, and sown in a garden soil of fair quality in Kirkee this season, only a very few specimens have lived to come above ground; and yet the seeds looked fresh and healthy enough. In several colonies to which seeds, such as corn and barley, have been sent from Europe, even these sturdy plants suffered from the change of climate, and it was only after the careful culture of a few years that they began to yield an abundant return. On the other hand the agriculturist knows well the advantage of having seed from a limited distance, where there is not any considerable difference in climate involved in the change. Those at all conversant with a pastoral life also know the change in height and appearance that takes place in the Shetland breed of ponies, when transported young from their native shores to the south of Scotland or to England. Such a change of pasture and climate has also no little influence on the breeds of cattle and sheep.

Indeed it is an article of our medical creed, that local climate, and quality of soil exercise an important influence over animal and vegetable life. Amid the dank exuberant vegetation of the jungle, diseases exhibiting great vascular excitement are but too common; amid the smoke-begrimed, tainted atmosphere of the great city what an enervated sickly debased race grow up, and who that has seen in the same sphere a few plants tortured into existence, can say that they looked healthy? The heather is a sturdier plant than the rose or the shamrock, and in general hill tribes are endowed with a physical energy superior to that of their neighbours of the plains. On a poor miserable soil, with scarce vegetation to cover its nakedness, we shall ever find a wretched and thinly scattered population. Looking backwards to the Geological eras of this venerable earth, we also find most wonderful relations, as to

rank in their respective kingdoms, existing between the classes of animals and vegetables living at the same time on the stage of the world. Thus during the Palæozoic division of fossiliferous history, amid awful forests, pestiferous jungle, and impenetrable underwood consisting of Monocotyledons, Gymnogens, Acrogens and Thallogens, there lived molluscs and a few reptiles, while the waters of the same period were occupied by corals and crustaceans, all animals of low type. Advancing to the next or middle great division, we find specimens of the classes enumerated as characteristic of the previous period, only modified in accordance with other features of that creation. In addition to these however, we have gigantic reptiles and birds, a few mammals and some dicotyledonous plants. Then comes the tertiary period, when the dicotyledon is king of the forest, when mammals of immense proportions are predominant, and reptiles are dwarfed into something like their present size. Thus throughout the two kingdoms we have a contemporaneous progression from the lower to the higher forms, as the earth is changed from an impracticable to the present world with all its beauteous creations, of which man is lord. We find no traces of his footsteps however, in the Palæozoic or any other formation, until the earth has been made a fit and pleasant habitation for him and his seed for ever. Neither have we a plant of the higher orders, living together with animals or vegetable forms of low caste, during an early fossiliferous era. The sun did not then shine with his present benignity, not a bird looked down on its shadow in those dreary waters teeming with monsters, never did its notes sing of verdant plains, of pleasant groves, of fertile valley and bounteous river, but the discordant cries of fearful forms, the weak in their death agony, the strong rejoicing in their might, startled the echoes amid forests of fabulous extent and trees of eccentric appearance. In each and all of these periods of Geological history, we find certain classes of animals co-existing with consonant grades of vegetable productions. We find not a single departure from this rule, for throughout all the works of the great Creator there is a constant harmony.

> "In reason's ear they all rejoice
> And utter forth a glorious voice,
> . . . .
> The hand that made us is divine!"

VIII. *Suggestions for a uniform System of Weights and Measures throughout India. By* W. H. BAYLEY, ESQ., *of the Madras Civil Service.*

The expediency of defining, by authority of Government, some standard of Weight and Measure, applicable to the whole of our Indian territories, is generally admitted; but what that standard should be, what its multiples, and how it is to be effectually introduced among the people, are questions on which opinions greatly differ.

No system can be specified which will not be open to *some* objection, and the object of this paper is simply to propose for the consideration of those interested in the matter, a few different modes of arranging the Weights and Measures, in order that the subject may be well discussed by those qualified to give an opinion, before any one system is authoritatively adopted.

With the exception of the weight of the Rupee, (180 grains), there exists no defined standard of Weight or Measure in India. There are certain traditionary standards, but these differ all over the country, and in practice are not adhered to, nor is there any Law on the subject, by which the gross irregularities that prevail can be checked.

In the adoption of a new and uniform system, it appears necessary either to determine on one that bears a close relation to the most prevalent of the existing Indian systems, or else to adopt one that will accord with the Imperial Weights and Measures of England. The former would be the most acceptable to the Native population, and therefore more easily introduced: the other would best suit the requirements of the increasing trade, and political connection, with Great Britain.

The subject has to be considered under four heads. I. Weight. II. Measure of *Length.* III. *Superficial* measure. IV. Measure of *Capacity.* The second and third points will be first alluded to, be-

cause, as regards those two, there seems less difficulty in coming to a conclusion as to the most applicable and feasible arrangement.

The unit of *Linear* measure in India, is generally the distance from the elbow to the tip of the middle finger of a tall man, and is of course no standard at all. This length is known as the *hat'h* or *moolum*, and averages 19½ inches. It is always translated *cubit*, though invariably exceeding the English cubit of 18 inches, by 1½ or 2 inches. In the Southern Carnatic, the *adee*, or length of a tall man's foot, is in use, and averages 10¼ inches. The *Guz* (translated *yard*) is partially in use all over India, but varies in different localities from 26 to 36 inches. In Bombay it is 27 inches, and in the North-West Provinces of India it has been defined by the Government, for the purpose of Survey, at 33 inches.

Although the above are the *Indian* linear measures, the English yard and foot are very extensively adopted by Native artizans; and in all the Public Works of India, which give employment to thousands of Natives, the English linear measure is universally employed. Considering therefore that this Measure is already so familiar to the people, and that their own is so undefined, and fluctuating in practice, there can be little doubt but that the English Yard and Foot should be determined on for the new Metrical system.

It might not be advisable to define the *subdivisions* of the Yard and Foot, till the question is settled in England. Both Parliamentary Committees that have reported on the subject of Weights and Measures, in 1841 and 1854, have recommended a *decimal* subdivision, and it has been adopted already as regards the *foot*, by English architects and surveyors.

The next point is *Superficial* measure; and this need only be noticed in connection with *Land-measure*. According to the ancient Indian system, an area of land is often named after the quantity of seed required to sow it, or the quantity it will produce, and of course the actual area differs according to the opinion of the person who makes the estimate. Where linear definition *is* given, mention is made of Rods or Ropes, of so many cubits, but

the cubit is undefined, and areas of the *same denomination*, are derived from different multiples of Rod or Rope. Of the more definite terms, the *Beega* prevails in Bengal and the North-West Provinces. In Bengal it is 1,600 square yards, and in the North-West Provinces it is 3,025 square yards. In the Bombay Presidency it is not authoritatively defined, but averages about ⅗ of an acre. The term is quite unknown in the Madras Presidency, where the authorised measure is the *Cawnie* of 57,600 square feet, or 1·3223 acre; there are also other local land measures, defined, but presenting great differences one from the other; as the *chain* of 3·64 acres, the *seed-cottah* of 1·62 acres, the *vaylie* of 6·6 acres, and the *bullah* of 3·82 acres.

The greater portion of the North-West Provinces of India has been surveyed by Government Officers. The area of each village (or rather parish, to use an English term) is given in Imperial acres, but the areas of the *fields* appertaining to each village, are given in local *beegas*. The introduction of the acre therefore was only partial. In the Surveys lately made in the Bombay Presidency, the area of each field is recorded in acres, not only in the English, but in the vernacular accounts, and the term is well known and understood among the people. In the Madras Presidency, the districts of Bellary and Cuddapah were measured field by field (as far as the land was cultivable) in acres, in 1803, and Kurnool in the same way in 1842. In Salem, the records of field measurements made about 1800, are entered both in the Native terms and their equivalents in acres, and the acre is by far the best known.

Under the above circumstances, the introduction of the Imperial acre seems not only most desirable, but quite feasible. Where lands have already been *accurately* measured, and contents recorded in Native terms, those terms might be converted into acres; and in the progress of the Surveys now going on, all measurements might be at once in acres. This plan has already been successfully adopted in the present re-survey of the Southern districts of Madras, and the acre is superseding the *cawnie.*

With regard to the *subdivisions* of the acre they have hitherto in the Madras Presidency been in 40ths (or Goontas), and

and 16ths of 40ths; or else in 16ths (annas) and 4ths of 16ths. A decimal subdivision is most desirable; not only is the computation far easier to the surveyors, but records in decimals, are far more intelligible than in Roods and Perches, and money values in relation to areas more easily calculated. The areas recorded in the Ordnance Survey of Great Britain, in which Survey every field is measured, are now in acres, *and decimals* to the third place. There cannot be a better authority for a decimal subdivision, and it offers no difficulty to the Natives, as regards *land* measurement.* The cawnie, itself, is in several districts in the Madras Presidency, subdivided into 100ths, and in the present re-survey of the Southern Districts of Madras, the decimal subdivision of the acre has been authorised, as stated in para. 11.

The next subject to be considered is that of Weight; and this is important, inasmuch as the best method of fixing a standard for measures of *Capacity*, is with reference to the *weight* of water they will contain.

The difficulty connected with determining a standard of *Weight* for the whole of India, is increased by the fact that there are conflicting interests and opinions on the subject. Some of the best authorities urge that the Ponderary system of India, already in some degree established, should be founded on the Rupee (the tola of 180 grains), as the standard coin of the country, always accessible in cases of doubt or suspicion. Others there are, who perceive in the increasing trade with Great Britain, the great want of some system by which the Weights and Measures of both countries may be assimilated, and they object to the tola unit, because no number of even tolas will correspond with one, two, three, four, five, six, seven, eight, or ten *pounds* avoirdupois, the nearest ratio being 350 tolas=9lb.; a most inconvenient proportion.

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* It is hardly necessary to argue why a decimal subdivision of *Land* Measure, should be easier of introduction than a decimal arrangement of Weights and Measures in general. It is, in practice, a mere division of account. In England not one person in a thousand is the least put out by the substitution of Decimals for Roods and Perches: whereas, not one in a thousand but would be inconvenienced (for a time) by the substitution of 10th of Gallons for Pints, or by Ounces of ten to the Pound.

An arrangement on the *Tola unit* will first be considered.

Though the larger Weights throughout India are utterly devoid (in practice) of rule or uniformity, being generally misshapen lumps of metal, or stones, and varying in value as well as denomination in every district almost,* there has from time immemorial been a small weight called a *tola*, in use by Goldsmiths and Jewellers, which has maintained a ponderary value of about 182 or 184 grains. When the Government of India, by Act VII. of 1833, (the main purport of which was to fix the weight of the Furruckabad rupee at 180 grains)† decided on 180 grains as the *tola*, they in the same Act declared that this tola should be "the unit of a "general system of *Weights* in all *Government transactions*."

The "Table" of Weights adopted by the Government of India for the use of their own offices, is in accordance with Native usage in Bengal, and was approved of by the Chambers of Commerce in Calcutta and Bombay. It is as follows:

1 Tola	=	180 Grains.
5 Tolas	=	1 Chittak.
16 Chittaks	=	1 Seer = 80 Tolas = 2·057143 lbs. avoir.
40 Seers	=	1 Mun = (or maund) = $82\frac{2}{7}$lbs. exactly.

* The traditionary and acknowledged unit of Weight is generally the RUPEE; thus the "Seer" is said to be so many Rupees weight; but it is very seldom possible to say what was the weight of the Rupee forming the original unit. The Rupees of the different Native Governments varied considerably, and even under the British rule the Sicca Rupee of Bengal was 192 grains, when the Arcot Rupee of Madras was 176½. These differences in the small unit would effect the larger ones considerably, and aggravate the uncertainty as to what was their original and real value. Besides this, terms of the same denomination do not by any means denote the same value. A Candy, (Khundee) for instance, in one place differs very much from the Candy of another place. Again, a Candy (for instance) of Metal, is not the same as a Candy of Tobacco; and there is a different Candy for Cotton and Sugar. The Candy used in buying, is not always the same in the same place, as the Candy used in selling.

† The Furruckabad rupee used in the N. W. Provinces, had hitherto been 180·234 grains. The Rupee of Madras and Bombay had been for some years 180 grains. The "Sicca" Rupee of Bengal still remained at 192 grains, but this coinage was discontinued in consequence of Act XVII. of 1835, and since that date the Company's Rupee of 180 grains has been the only Rupee coined at any of the Government Mints.

If any system of Weights is to be selected from those now current in any part of India, the above seems to be the best, not only because it is founded on a defined standard, originating in the weight of the coin of the realm, but because it includes the "Seer" of 80 tolas, which is a weight known and acknowledged in *some* degree all over India. It is in short a Ponderary system which as far as *facility of introduction* is concerned, has a preference over any other.

It may however be well here to notice a remark that is sometimes made with reference to the Legislative Enactment above referred to, and the Official "Table" of Weights; and this is, that it is needless to discuss any new scheme for a Metrical System, inasmuch as the law has been already declared on the subject, and the system actually in force; all that is required being an endeavour to extend its use where prejudice has already prevailed against it.

In reply to this it may be observed, first, that the Enactment refers only to *Weights;* and secondly, that it only effects *Government transactions.* Surely that cannot be called a Metrical system which merely defines the Weights that the Government prefer for their own use, and which leaves untouched the subject of *Measures*, a point (in India especially) quite as important, and much more difficult to arrange than that of Weight. Neither can it be said that a system is in force, which is a mere guide for the terms of account in Official papers, and by no means obligatory on the people. I can confidently assert that, as regards the 140,000 square miles comprised in the Madras Presidency, not a single bazar-man has altered his Weights one grain, or his Measures one fraction of a cubic inch in consequence of the Calcutta notification. Neither was the Act intended to go farther than legalise the tola as a *unit.* The "Table of Weights" has never been adopted in the Madras Presidency, even in *Government transactions.* In the Fort St. George Gazette of the 20th October, 1846, the following Table of Weights was published as that which was to be used in that Presidency:

180 Grains	=	1 Tola.
3 Tolas	=	1 Pollum.

40 Pollums =	1 Viss	= 120 Tolas =	3·0857lbs. avoir.
3 Viss =	1 Maund	= 960 Tolas =	24·6857lbs. avoir.

This "Table" was sanctioned for Madras by the Government of India, and is, as will be seen on comparison, entirely different, with the exception of the tola unit, from the Weights adopted for Calcutta.

The above remarks are made with the view of dissipating the illusion that a Metrical system has already been defined by law, and is actually in use to a considerable extent. The universal introduction therefore of the Calcutta Table, although easier than that of any other, would still not be quite so simple a matter as some persons have been led to expect. In the Madras Presidency it certainly would be difficult to get rid of the present Native systems of Weights, which in general correspond with the Table promulgated by the Government of that Presidency.

It will be observed that the Madras Government Table does not acknowledge the "seer" weight at all; but still a seer weight of 80 tolas, known as the "pucka" seer is met with all over India. It is not much in use in Southern India, where the "seer" of 24 tolas, called the "cutcha" seer, is more common.* There are also "seers," both in Madras and Bombay, of 84 Rupees weight. Still, a seer of 80 tolas could no doubt be more easily introduced throughout India than any other weight.

The Calcutta Official "mun" or maund, is 82$\frac{2}{7}$lbs. avoir., and is not known in any part of the Madras Presidency, except at the Government Salt Depôts, and in the Coast trade of grain to the port of Madras. The Madras maund is 25lbs; the Bombay maund is 28lbs.; and the Surat maund in use on the Western Coast is 31$\frac{1}{3}$lbs.

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* The original unit of WEIGHT in Southern India, seems to have been the gold coin called by the English, a "pagoda." It is now uncurrent, but was about 52$\frac{1}{2}$ grains weight. 80 pagodas weight is, according to the Native Tables, a "seer" (cutcha) of 24 RUPEES weight. This corresponded with the average weight of the old Native rupees of 175 grains; but since the introduction of the "Company's rupee" of 180 grains, the "pagoda weight" is 54 grains generally. The same confusion formerly existed in Bengal, between a Sicca WEIGHT of 179$\frac{2}{3}$ grains, and a Sicca RUPEE of 192 grains.

The chief objection to the Ponderary system enunciated by the Government of India, is that it cannot be made to accommodate itself to the Imperial Weights of Great Britain, and this, considering the importance of the trade between the two Countries, and the fact that one is a Dependency on the other, is a serious drawback.

The following Table shows the nearest proportions that can be obtained, for converting the above system of Weights, to those of Great Britain (avoirdupois).

38·889 Tolas	=	1lb.
350 Tolas	=	9lbs. *exactly.*
1 Seer	=	2·057143lbs.
35 Seers	=	72lbs *exactly.*
1 Mun	=	82$\frac{2}{7}$lbs. *exactly:* or (82·2857143. . .)
7 Muns	=	576lbs. *exactly.*
49 Muns	=	36 cwt. (of 112lbs.) *exactly.*
27·216 Muns	=	1 ton (of 2240lbs.)
490 Muns	=	18 tons *exactly.*
300 Muns	=	11 tons (strictly 11·0204.)

It will be seen that under such a system, there will always be difficulty and confusion in adjusting the weights of articles of commerce to the English Table, and as the connection between the two countries increases, and the European element becomes more marked, the inconvenience will be more practically felt.

Much stress has been laid upon the advantage of the 'Seer' and 'Mun' of the above Table, in consequence of the "Seer" being exactly equivalent to 2½lbs. Troy, and the "Mun" exactly 100lbs. Troy. There is no doubt some convenience in this to the *Mint*, but except as regards Bullion, and Medical prescriptions, *Troy* weight is practically unknown. The Parliamentary Committee in their Report on the 'Restoration of Standards' in 1841, condemn it as "useless;" and the Committee in their Report of 1854 on the 'Construction of the Standards,' state that "there is now a prospect of "attaining the long desired simplification of the British system of "Weights, by the entire suppression of Troy weight." To defend the Seer of 80 tolas and the Mun of 40 seers, because they correspond with *Troy* weight, may therefore be considered useless.

Mr. Prinsep, in his "Useful Tables" gives a list of some 300 Rupees of Native Mints, mostly of dates prior to any regular coinage of the Indian Government. They average about 175 grains; and had the Government adopted 175 grains instead of 180 for the rupee, a "Seer" of 80 rupees would have been exactly 2lbs. *avoirdupois;* and a "Mun" of 40 seers, exactly 80lbs. *avoirdupois*, and 25 Muns exactly 2,000lbs., or the proposed new *Ton* for Great Britain. The rupee of 180 grains is *now* so well established in all the Presidencies, and there is such an enormous silver circulation in India, that it seems impracticable to reduce the Rupee to 175 grains; and if the same content of pure silver were retained, (which would be necessary for the credit of the State) the "touch" would be raised from $\frac{11}{12}$ or ·91666, to ·942, which may be deemed too high for durability. The touch of silver in France (where, as in India, it is the legal standard of value) is ·900. In England it is ·925.

Another objection may be made to the above Ponderary system, namely, that the multiples are not *decimal*; but the main advantage of this system, is the comparative facility with which it might be introduced, and this advantage would be lost if the usual multiples were departed from. The only improvement that might be effected without materially interfering with the reception of the system, would be to subdivide the "seer" into 80ths, or single rupees, instead of into 16ths, or chittacks. The division by 80 would be simpler than by 16; the commercial minimum weight of account would be 180 grains, instead of 900 as at present, and the "quarter chittacks" would be unnecessary. The lowest denomination of Avoirdupois weight in England, is the "dram," or 27·344 grains; but this the Parliamentary Committee of 1841 state "does not appear to be used at all." The $\frac{1}{4}$ ounce, or 109$\frac{3}{8}$ grains, is the lowest weight in general use.

The next plan for a system of Weights, that may be noticed, is that in which the "tola" of 180 grains, (being the weight of the Rupee) is the unit, and its multiples Weights of 10, 100, and 1000 tolas. It is hardly necessary to urge that such a decimal arrangement, however desirable for its intrinsic merit, would be unacceptable both to the Native and the European community.

It would not coincide (except as regards the single tola) with any one of the Native Weights in India, and this with the attempt to introduce at the same time a novel system of notation, would be fatal. The mercantile community, and those who are desirous to see the Indian and English Weights assimilate to some degree, would of course not be satisfied with such a scale.

Another proposition is to adopt the English Imperial Weights at once. The great objection to this would be the difficulty of introducing all over India, a Weight so new to the people as *a pound*. It would represent neither a "seer," (pucka or cutcha) a "pollum," a "chittack," or a "viss," or any definite proportions of them. Again, the question of multiples and sub-multiples is not settled yet in England, and till this is decided, it would be unwise either to endeavour to enforce in India the present English notation, which will probably be altered ere long, or to anticipate a *decimal* arrangement, and introduce multiples which may not eventually be adopted in Great Britain.

There is however a Ponderary system, which I venture to propose, as uniting the advantages of assimilation with the coin of the country,—assimilation (within close limits) with the best known of the existing Native Weights,—and assimilation with the Imperial Weights of Great Britain.

I would propose a "seer" of $77\frac{3}{4}$ tolas, instead of 80. As far as the facility for testing doubtful weights by the coin of the country, this would answer as well as 80 tolas, for a quarter rupee is just as much a coin of defined weight (45 grains,) as a whole rupee, and where one can be obtained, the other can.

This "seer" would differ $2\frac{1}{4}$ tolas weight from the one adopted for Government transactions in Calcutta, but practically the "seer" Weights in India, even though professing to be 80 tolas weight, are seldom so much. The seer is generally said to be so many *rupees* weight, and as the rupees of former days, on which these seers were founded, averaged about 175 grains, (see para. 28) the *original* weight would be more nearly obtained by a "seer" of $77\frac{3}{4}$ tolas. Besides, the 80 tola "seer" is not universal; it has

already been stated that the "seer" weight varies in different localities, and to substitute a $77\frac{3}{4}$ tola weight in these localities, would not be more of an innovation, than substituting a "seer" of *eighty* tolas.

The "seer" of $77\frac{3}{4}$ tolas would be only 5 grains short of a *double pound*, or two pounds avoirdupois; that is, it would be 13995 grains, instead of 14000; which would only make a difference of 1·42lbs in the proposed new *Ton* of 2000lbs, a difference within the limits of error in weighing. It would be advisable perhaps, to *define* the "seer" legally, as equivalent to two avoirdupois pounds; and it might at the same time be declared that a seer of $77\frac{3}{4}$ tolas weight would not be condemned as short. It is undoubtedly an advantage to have Weights which correspond with the coins of the realm, but it never could be intended, that testing by coins *in use*, should supersede testing by certified standards. The assimilation to coin weight is desirable as a means of readily checking irregularities, but in practice no one would be able by coins, even if new, to state for certain whether a weight was 80 tolas, within 5 grains.* The advantage therefore of a coinage equivalent would remain, if the "seer" weight were defined as *two pounds* English.

The only weak point in the adoption of this "seer," is that its sub-multiples could not be so simply arranged as those of the 80 tola seer, which can so easily be resolved into 80 single tolas. The $77\frac{3}{4}$ tolas could not be subdivided into single tolas, or even into the favourite Native subdivision of 16ths, so as to give an even number of tolas; but this defect (and all systems that can be proposed will have *some*) is more than counterbalanced by other advantages.

I would propose that this "seer" be subdivided into 16ths, as the present seer is. A division by 16 would be much more acceptable to the native community than a decimal one, and all clerks

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* The difference between $77\frac{3}{4}$ tolas, and 2lbs., is only equivalent to 1-16th of a grain in the rupee, an amount certainly too small to be taken into account when testing weights by coin in circulation.

and accountants in India can divide by 16 as readily as Englishmen by 12. There are also 16 Annas to the Rupee, which makes the number convenient. With regard to the *sub*-multiples of the "seer," a coincidence with the smaller English Weights, is not of much consequence in commerce. As regards the *multiples*, I would propose a "Mun" or maund Weight of 50 "seers," which would be exactly the cwt. of 100lbs., which will no doubt, be soon established in England, whatever may be the other decimal multiples and sub-multiples.*

The next point to be considered, is a standard for the Measure of CAPACITY. It will be observed from what has been stated in paras. 16 and 17, that the Government of India has neither in Act VII. of 1833, nor in the "Table" set forth by them, made any allusion to *Measure of Capacity*, although it is a matter of more importance than the Weights, seeing that by far the greater portion of the domestic transactions in India are in *grain*. The Calcutta Chamber of Commerce, when on the 19th of May, 1836, they resolved to adopt the *Weights* of the Government, urged the introduction of the Imperial gallon for *Liquids*, and proposed that new Measures of capacity for grain, should be regulated by the Weights, but they did not show how this was to be done: nor does it seem at all necessary to make a distinction between "Dry" and "Liquid" Measures. The Government declined to act on the recommendation of the Chamber, and whatever might have been contemplated by Act VII. of 1833, nothing has ever been announced by way of defining the capacities of the Grain Measures in Bengal. The only Measures made up (at the Mint) by authority of the Government, are the Imperial gallon and its sub-multiples, for use in the Medical and Victualling departments; and it seems that the Court of Directors in their Despatch of 17th July, 1833, expected the "gene-

* It is stated in the Report, dated 1854, of the Commissioners appointed to superintend the construction of the new Standards, 'Referring to chapters [named] "of the Report of 1841, and the recommendations based thereon, tending to diminish the confusion between Avoirdupois weight and Troy weight, and to banish the Stone of 14lbs, and the Hundred weight of 112lbs, we have to report "that we adopt in their utmost extent the whole of those recommendations.' The Committee of 1841 recommended a "centner" of 100lbs., and a "stone" of 10lbs.

ral adoption in India" of the Imperial Measures. The *Madras* Government however in their Notification referred to in para. 20, promulgated a Table of Measures to be used in Government transactions, as follows :

1 Olluck	=	12½	cubic inches.		
8 Ollucks	=	1	Measure (Puddee)	=	100 cubic inches.
8 Measures	=	1	Marcal	=	800 cubic inches.

And this arrangement was sanctioned by the Supreme Government for the Madras Presidency. Though 10 years have elapsed, these Measures have not been adopted by the people ; and even in the Town of Madras, the Government have authorised the stamping with the Government Seal, the "customary" Measure or "Puddee" of 104¼ cubic inches, which has been the *real* standard since 1802.

In Bombay, the Government have attempted to introduce a "Seer-measure" of the capacity of 57 cubic inches, but this being so much smaller than the usual "Seer-measure" of that Presidency, the scheme has not met with success.

Mr. James Prinsep in his "Useful Tables" observes that "India does not, properly speaking, possess Dry or Liquid Mea- "sures. Where these are employed, they depend upon, and in "fact represent, the "seer" or "maund" *weight.*" This is true of India generally, but in the neighbourhood of Madras, as already shown, and in some of the Southern Districts, the ordinary grain Measure is a "puddee," which does not represent any weight;" and the "puddee" varies greatly in different localities.

The most common grain Measure, and one which is to *some* extent known in almost every part of India, is the "seer-measure ;" this is always understood to be a Measure which *when heaped* will contain a "seer" *weight* of rice, or in some places instead of rice, a mixture of the 9 most common grains, known as the *nou-danium* measurement.*

As only *heaped* measure is recognised by Native usage, it is evi-

* The 9 grains used in the Madras Presidency, are Rice, Chenna, Cooltee Pessoloo, Minamaloo, Dholl, Anamaloo, Gingely oil-seed, and Wheat.

dent that there is no rule as to the *cubic content* of the Measures used; for vessels of very different cubic content may contain the same when heaped, in consequence of having different diameters. It is on this account that the values given to Indian Measures, in such Tables as those of Major Jervis, or Dr. Kelly (in his Cambist) being founded on the guaged cubic contents, do not represent the true quantities.

In 1852, the Madras Board of Revenue instituted a special enquiry into the Grain Measures of each district. They were found to be of all shapes and materials. Some were in the form of hour glasses; some were joints of bamboo; and some earthenware pots; but as a general rule, it was found that they were in most districts intended when *heaped*, to contain a seer weight, or a definite number of seers, either of rice, or of mixed grain, but usually rice: and the "seer" weight was generally that of 80 tolas. Measures in every district were guaged with Water, Rice, and Cooltee or Horse gram, and it was found that (taking 100 cubic inches of water to weigh 140 tolas, which at a temperature of 81° is true to ½ a grain) Rice on an average, weighed 113 tolas to the 100 cubic inches.* From experiments made by myself a few years ago, I found 100 cubic inches, of the 9 mixed grains, to weigh 115 tolas. From the Reports of Mr. Shaw, of Ahmedabad, in the Bombay Presidency, in 1849, it appears that he found that a Measure holding 137¼ tolas of water, held when struck 114⅔ tolas of mixed grain, which gives 116½ to 100 cubic inches; and Mr. Reeves, of Poona, found that a vessel containing 80 tolas weight of water, would hold 66¾ tolas of mixed grain, which also gives 116½ tolas to 100 cubic inches. Cooltee, or Horse gram, was found by the Madras experiments to average 116 tolas to 100 cubic inches, but it varied from 113 to 118. From the same experiments, the weights of the *heaps* (of rice) on various diameters were determin-

* In the Northern Districts, it averaged 111 Tolas; in the Town of Madras 114 and in the other Districts 112 and 113. The rice used was what is called in Madras, "Putcharisee," or RAW RICE, to distinguish it from "Poolungul," or that which is scalded before husking. Old rice would weigh something lighter.

ed, as shown in the margin; but it is probable that the dealers in the bazaar, would not heap quite so liberally. The accuracy is of course not so great but that the diameter may be considered either the inner or outer.

Diameter Inches.	Tolas wt. of Rice in heap.
2	2
$2\frac{1}{4}$	$2\frac{1}{2}$
$2\frac{1}{2}$	3
$2\frac{3}{4}$	$3\frac{1}{2}$
3	4
$3\frac{1}{4}$	$4\frac{1}{2}$
$3\frac{1}{2}$	5
$3\frac{3}{4}$	6
4	7
$4\frac{1}{4}$	9
$4\frac{1}{2}$	11
$4\frac{3}{4}$	13
5	15
$5\frac{1}{4}$	18
$5\frac{1}{2}$	21
$5\frac{3}{4}$	24
6	27
$6\frac{1}{4}$	30
$6\frac{1}{2}$	34
$6\frac{3}{4}$	38
7	41
$7\frac{1}{4}$	45
$7\frac{1}{2}$	49
$7\frac{3}{4}$	53
8	58
$8\frac{1}{4}$	63
$8\frac{1}{2}$	68
$8\frac{3}{4}$	74
9	80
$9\frac{1}{2}$	92
10	104

The best "Seer-measures" are about $3\frac{1}{2}$ to $3\frac{3}{4}$ inches in diameter, and 6 inches deep, but they are never true cylinders. Their cubic contents are from 66 to $66\frac{1}{2}$ cubic inches, holding from 74 to 75 tolas of rice when *struck*, and 80 when heaped. It so happens, as may be seen by reference to the Appendix,* that a vessel of $66\frac{1}{10}$ cubic inches capacity will contain at a temperature of 84° (a good *day* temperature for India,) 16650 grains, or *exactly* $92\frac{1}{2}$ tolas weight of water. This would hold on an average when *struck*, $74\frac{1}{2}$ tolas weight of rice; and with a diameter of 3·7 inches, 80 tolas if *heaped*. Thus if a "seer" of 80 tolas be adopted, such a Measure would be exactly what is understood by the Natives of the country to be a "Seer-measure."

No measure of capacity could be more easily introduced than this, and a Table † might be framed, according to which the multiples of the Seer should bear a correct proportion when *struck*, and also as correct a ratio when *heaped*, as the circumstances of the case will admit; at all events nearer than has hitherto satisfied Native usage.

The sub-multiples of the "Seer-measure" are generally (not always) used for *Liquid* measures in India. The only liquids sold by measure, are Ghee, (clarified butter,) Oil, and Milk. No defined measure is used for Arrack and Toddy (intoxicating liquors), and

* Vide page 212.

† Vide page 198.

Spirits in Madras are sold by the "dram" of 5·775 cubic inches, or $\frac{1}{40}$th of the old Wine gallon.

Instead of making 40 "seer-measures" = 1 "Mun-measure," which might cause a confusion in the terms of Weight and Measure, (and the term Mun or Maund is not in use as a grain measure in Southern India,) it would be better to give some name to a quantity represented by 100 Seers. This might be called a "Sotee," from *so*, a hundred. The "Table" adverted to in the preceding page, would be as follows :

DRY AND LIQUID MEASURES.

Seers.	Cubic inches.	Tolas of Water.	Tolas of Rice when struck.	Tolas of Rice in heap.	Total weight.	Diameter inches.	Depth inches.
I.	61·1	92½	74½	5½	80	3·7	6·2
II.	123·2	185	149	11	160	4·5	7·7
III.	198·3	277½	223½	16½	240	5·3	9.0
IV.	264·4	370	298	22	320	5·7	10·3
V.	330·5	462½	372½	27½	400	6·2	10·9
VIII.	528·8	740	596	44	640	7·3	12·8
X.	661·0	925	745	55	800	7·7	13·0
LIQUID MEASURE.							
½	33.0	46¼				3.0	4·7
¼	16·5	23⅛				2·5	3·4
⅛	8·25	11 $\frac{9}{16}$				·2·0	2·6

Although the above plan for Measures of *Capacity* would probably have the great advantage of facility of introduction, yet it is objectionable for any Government to lend a sanction to *heaped* measure ; moreover it will be observed that such a system does not accommodate itself at all to any English Measure of Capacity. Lastly, it would be *indispensable* that in every Measure used, the exact diameter be retained, in order to secure correctness (as far as it can be secured) in the heaped measure. This would give rise to a great deal of inconvenience, and is not a necessary element where *struck* Measures only are acknowledged.

I would propose as a Measure of *Capacity*, a vessel to be called a "Seer," but exactly equivalent to an Imperial Quart. The present "seer-measure" averages a capacity of 66½ cubic inches: the Quart is 69·3185. The present "seer-measure" contains when *struck*, about 74 tolas of rice, or 76 of mixed grain, and about 80 tolas of either when heaped: the Quart would contain 78 tolas of Rice, or 80 of mixed grain when *struck*, and (with a diameter of 4 inches,) about 86 tolas when heaped; but heaped measure should not be recognised by Government. I cannot but think that if there exists an English Measure which corresponds (taking *struck* content) so closely either to the Native "seer" of 80 tolas, or to the "seer" of 77¾ tolas which I have proposed, that it should be adopted, whichever of the two "seers" of *weight* the Government may select. It is also to be added, that the Quart will contain an even number of tolas (rupees) weight in water; namely, 17460 grains, or 97 tolas *exactly*, at a temperature of 84° Fahrenheit. This may be calculated from the Table at page 212.

The "Seer-measure" then, would be defined as a vessel containing 97 tolas of water at a temperature of 84°, and its bulk 69·3185 cubic inches. A reference to the water being *distilled*, or to the height of the Barometer, will not be necessay in practice. The Barometer in the Tropics fluctuates very slightly, and a fall of 1 inch, due to an elevation of about 940 feet, would only make a difference of ·615 grain, to be deducted from the normal 97 tolas assigned to the Quart-seer.

It would not be necessary, if the Government recognised *struck* measure only, to define the diameters (or even the shapes) of the vessels of capacity, for all that is required is that they contain a certain number of tolas weight of water. Still for uniformity's sake, and the more easy discovery of fraud, the vessels should be cylindrical, and it would be desirable that the models, as well as all vessels made up at the Government Stores, should have a diameter proportionate in some simple ratio, to the depth. The diameter the same as the depth would be the best, but those who are accustomed to measuring grain and salt, assert that this would be too broad to be convenient, and a diameter one half the depth too

narrow. A good proportion is that of 3 to 4, and the contents of a cylinder being given, it is easy to compute the requisite diameter and depth.

Let s=cubic contents given.
d=diameter to be found.
h=depth to be found.
3:4=diameter to depth.

Then [I] $d = \sqrt[3]{\frac{s}{\cdot 7854 \times \frac{4}{3}}} = \sqrt[3]{\frac{s}{1\cdot 0472}}$

And [II] $h = \frac{s}{d^2 \times \cdot 7854}$

From these Formulæ, we obtain the following Table for both *Dry* and *Liquid* Measure.

Quarts.	Tolas water. at 84°	Cubic inches.	Diameter in inches.	Depth in inches.	Tolas Rice. 113 tolas to 100 cub. in.
I.	97	69·3185	4·04	5·39	78·3
II.	194	138·6370	5·10	6·80	156·6
III.	291	207·9555	5·83	7·80	234·9
IV.	388	277·2740	6·42	8·57	313·2
V.	485	346·5925	6·92	9·28	391·5
VIII.	776	554·5480	8·09	10·79	626·4
X.	970	693·1850	8·71	11·62	783·0
½	48 ½	34·66	3.18	·425	39·2
¼	24 ¼	17·33	2.55	3·40	19·6
⅛	12 ⅛	86·65	2·00	2·68	9·8

If the "Seer" Weight of 77¾ Tolas=2lbs Avoirdupois, be adopted, the "Seer-measure" will, if the vessel be struck, correspond sufficiently ; for the weight of rice varies from 112 to 114 tolas to 100 cubic inches ; and if the 9 grain standard is taken, the above "Seer-measure" will contain just 80 tolas, (at 116 tolas to 100 cubic inches) and be when *struck*, the exact equivalent of what is now the average "Seer-measure" when *heaped*. This of course will render its introduction much easier than any other struck Measure that can be adopted.

Even in Madras, where the "Seer-measure" is not recognised

in the Government Notification, such a Measure averaging 80 tolas weight of Rice when *heaped*, is in use in many of the Districts, and the Sepoys of the Native army always buy by the Seer, generally considering it to be $\frac{2}{3}$ of the Madras "Customary" Measure of $104\frac{1}{4}$ cubic inches, which would give $69\frac{1}{3}$ cubic inches, or an Imperial Quart. On the 17th July, 1855, the Madras Government, in consequence of some dispute on the subject, decided that the Sepoys' "seer-measure" should be $5\frac{1}{2}$ of the "Ollucks" named in their proclamation of 1836, or $68\frac{3}{4}$ cubic inches. This closely corresponds with the Quart of $69\frac{1}{3}$ cubic inches, which I propose as the standard "Seer-measure."

The only multiple of the "Seer-measure" that seems necessary for Accounts, is one of 100 seers, which might, as proposed in another place* be called a "Sotee." For *sub*-multiples I would propose *eighths* (âtees) as more in accordance with Native usage. It is seldom that a less measure appears in Commercial accounts than single seers, and therefore there is not so much object in a Decimal *sub*-division.

The objection to the "Seer" proposed by the Bombay Government, which is a vessel holding a Seer of 80 tolas weight of water, or a capacity of 57 cubic inches, is that it is a *misnomer*. If the Native term "Seer" is to be used at all, it should be the Native idea of a Seer, that is, a vessel containing a seer weight of *grain*. The new Seer for grain is not what it is supposed to be, and it is no wonder that success has not attended the attempt to introduce what the people consider a deception. A little difference *above* the usual "Seer," would not have been of so much consequence, but this proposed Seer only holds 70 tolas of mixed grain, even when *heaped*. If it were desired to have a Measure analagous to a Seer, to contain a definite number of tolas weight of water, it surely would have been better to have guaged the Bazaar Seers with water,† and have taken the average weight in tolas, about 93, and fixed on that for the standard Seer-measure ; but if the "Seer-measure" is *not* to accord at all with the Native Measure,

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* Vide page 198.

† The Bombay Government in their Proceedings of the 30th July, 1849, proposed this, but it does not seem to have been acted on.

it would be just as easy, and far better on other grounds, to introduce an English Measure of Capacity at once.

With reference to the selection I have made of the Quart-seer, (in consequence of its closely representing the Native " Seer-measure," and also the two pound " Seer-weight,") it may be said that in the reform likely to be made in the English Measures, the Quart will disappear, as not being a decimal part of a Gallon ; but at all events the measure will be a *quarter* of a Gallon, and render an accommodation to English Measures quite feasible. But it is not certain that the Quart *will* be abolished, and it would be premature to argue on the supposition.

The Metrical System then that I would propose for India, as combining more decidedly than any other that I can think of, the three great objects, viz., assimilation to the English system, approximation to the existing Native system, and a means of testing both Weight and Measure of Capacity by the coin of the country, is as follows : I. For *Linear* measure, the English yard and foot, without at present defining the subdivisions. II. For *Land* measure, the Acre, decimally subdivided. III. For *Weight*, the Seer, of 2lbs. avoirdupois, corresponding to $77\frac{3}{4}$ Rupees weight ; with a multiple of a " Mun" of 50 seers, (= 100lbs.) and sub-multiples of " Annas" or 16ths of Seers. IV. For Measure of *Capacity*, a " Seer-measure" identical with the English Quart, and defined as containing 97 tolas of Water at a temperature of 84°, (containing when struck, about a " Seer-weight" of mixed grain) with a multiple of a " Sotee" or 100 seers, and sub-multiples of " ătees" or eighths.

It will be observed that in my proposed arrangement, no attempt has been made to introduce a *Decimal* scale ; and to remove the supposition that I have (as many *do* have) a prejudice against a decimal system, I must, at the risk of egotism, explain that there are perhaps few unprofessional men who make more use of decimals than I do. I have for many years been in the constant habit of using the Slide Rule, essentially a decimal instrument, and it is more natural to me to write ·125 than $\frac{1}{8}$. In my official capacity I have urged, and eventually with success, a decimal subdivision of the Acre in the new Revenue Survey of the Carnatic, and

I have also had occasion to recommend a decimal notation of the Assay reports of the Madras Mint. My own feeling on the subject would therefore make me most anxious to adopt a Decimal system, and I would advocate it most strongly for England; but for India, as India is at present, I cannot do so conscientiously, for I am convinced that it will be difficult enough to introduce any new Metrical system among a people so peculiarly wedded to custom and usage, and that to attempt at the *same time* to introduce a new *notation* would result in a total failure. If Englishmen would consider how much they would object to a decimal subdivision of the *Day* and *Hour*, they would have some idea of the objection of the Natives of India to a decimal division of Weight and Measure. There is not the same difficulty in the decimal *multiples* of an accepted Unit of Weight or measure, as there is in the *sub*-multiples. In England there would be less difficulty in introducing Weights of 10lbs. and 100lbs., than those of 10ths and 100ths of lbs., and Measures of 10 and 100 Gallons, than those of 10ths and 100ths of Gallons, and it is on this account that I have proposed decimal multiples* and binary *sub*-multiples for India. The multiples of the seer will bear a definite relation to British Weights and Measures; the *sub*-multiples will not, but then the definite relation is not so much required when small quantities only are in account.

The question is not which is theoretically the best system, but which can be so introduced, as to secure equivalents with the British system, and at the same time preserve some established standard of the country. The intrinsic merit of a Decimal *Coinage* will not be denied, and yet I have not met with any one acquainted with India, who would venture on a change. The same reasons influence me in objection to a Decimal *Metrical* System for India. In some respects, the latter is of more difficult introduction than the former. Professor Airy, (the Astronomer Royal) stated in his address at the Institution of Civil Engineers, Feb. 28th, 1854, that "a decimal scale could be, and ought to be, enforced in *coinage*, but scarcely in any thing else;" and as regarded

* That is multiples of the SEER. No decimal multiples of the TOLA will correspond with English weights.

Weight and *Measure*, it would be "perfectly vain."* It is however probable that the attempt will be made, but it is not *yet* made, and if this caution is observed in a country like England, it certainly ought to be exercised in India. A Decimal system is peculiarly adapted for *account*, but for the ordinary transactions of life, which affect the mass of the people, the binary scale is the most natural, and the most convenient in every country; and in India, the interests of the mass demand that it be preserved in the *sub-multiples* at least, of the Metrical standards.

Lastly, I will advert again to the fact that the Indian coinage is not decimal; the Rupee being subdivided into 16 Annas, and each of these into 12 Pies. Unless the coinage is altered,—a measure which I conclude the Government will not venture to attempt at present,—the chief advantage of a decimal Metrical system is lost. On this point I would refer to the evidence of Professor De Morgan, the ablest and most zealous of the advocates for a Decimal system in England. When examined before the Parliamentary Committee of 1841, appointed to consider the subject of the "Restoration of the Standards," the Professor stated that in his opinion "*no decimal scale is practicable, that does not begin with the money.*" (Page 60. H. 10.)

The next point for consideration, is the best method of *introducing* a new and uniform Metrical system into such a country as India, comprising as it does such an enormous extent of territory, and containing so many races of people speaking different languages, already possessing each their own established Weights and Measures, and deeply prejudiced against innovation.

It is the opinion of some who are acquainted with India, and whose views are entitled to respect, that the introduction of a new Metrical system should not be attempted by any compulsory measure, but be urged upon the people by encouragement, persuasion,

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* The Decimal system was established by law in France in 1795, but as regarded Weights and Measures it was found that its enforcement was so difficult, that in 1816, the "systeme usuel" was enforced for Retail Trade. It was not till July, 1837, that it was decided finally to adopt the decimal scale, and to enforce penalties for the use of any other. The law came into force on the 1st of January, 1840.

and personal influence ; in the same manner in short, as the introduction of European literature and science, or Christian ethics. I would submit however that the cases are not parallel ; we *must* wait for the one, we *cannot* wait indefinitely for the other. In the one case the Government has *no right* to compel the adoption of their views, however correct and beneficial ; in the other, it becomes a *positive duty* of the State to insist upon a just and definite mode of dealing among its subjects, and to introduce a new and uniform system, not merely because they have found a better one than any which exists in India, but because the existing ones are radically bad, and open a door to every kind of uncertainty, evasion, and fraud.

It does not require much argument to show that the Natives of India will not of their own accord do what the people of England would not do without a legal enactment, and if there *is* a Law, it must be compulsory, or it will be a dead letter. It would have been deemed useless to attempt the introduction of a uniform Metrical system by a Proclamation in the Gazette, or by official influence, in England, where all classes of people admitted the inconvenience of so much diversity, and it is not likely that such measures will be successful in India, where the people do *not* admit such inconvenience, and the petty dealers are *directly interested* in a continuance of the present irregularity. If official influence is to be exerted, it will probably end in that kind of influence which is virtually compulsion ; a species of argument not unknown to official subordinates in India, and which it would not be wise to encourage.

It may be thought that as it is already a penal offence to use false Weights and Measures, the public are sufficiently secured ; but there is little use in testing them as long as the Standards are *not defined* by law. I may mention a few instances that have come under my own knowledge, of the inconvenience arising from this laxity.

The first case was one, where the Land Revenue having been fixed originally with reference to the produce and price of grain, complaints were made of its pressure, in consequence of a continued fall (as it was asserted) of price. To ascertain the truth of

this, was of vital importance, and investigations were made by Government, in the course of which it was discovered that in one District, the official "Price Returns" had been 20 per cent. in error for some years, in consequence of the grain-dealers having altered the capacity of their Measures. In the second case, a merchant at a seaport town, sold a certain number of "candies" of copper to a captain of a vessel, who found on re-weighment for sale at Madras, that the weight was short. The seller was able to show that he sold by the Candy where he resided, and if the dispute had not been settled by an amicable arrangement, no official authority could have decided the question, inasmuch as the Candy is so many Seers, and the Seer so many Rupees, but *what* Rupee no one can tell: certainly not the present one, which is some grains heavier than the Rupees of the Native mints, current when the Weights were originally established. In the third case, a long correspondence took place in the Military Department, in consequence of a dispute as to whether a regiment of Sepoys had not overdrawn their rations; it being asserted that the Seer-measure of the town where they were quartered, was too large. The Government requested the opinion of the Board of Revenue, but the only answer they could give, was that the Native "Seer" differed in different places, at the option of the bazaar-men, and that as the Government in their Proclamation had made *no mention of a Seer* for use "in Government transactions," there was no official definition of such a Measure. In the fourth case, the Board of Revenue at Madras were informed that Measures of Capacity were in use in the Town, bearing the Government stamp, and yet differing in capacity from the content prescribed by the Proclamation mentioned in another para. of this Paper.* These Measures were examined, and found to be 4 per cent. in error, but the Stamping Department asserted that they were in accordance with an *old Standard* in their Office, and the Government declined even to prohibit their Seal being affixed to Measures openly at variance with their own Proclamation. All these instances occurred within three or four years, and similar cases hap-

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* Vide page 194.

pen constantly, for want of some positive law on the subject, and the evil cannot be remedied by a mere Proclamation, which is not binding. It is now 10 years since the Madras Proclamation was published, and models distributed over the country with injunctions to the Public Officers to press their adoption; but, with very few exceptions, the attempt has failed, and those very exceptions only add to the discordance already prevailing. It is to little purpose for Government to proclaim a Standard, if its use is not enforced, or if it is not to be considered as decisive in case of dispute. It appears obvious, that where such inconvenient discrepancy and uncertainty exist, it is the duty of Government to decide upon some Standard, and having once decided, not to allow the people the option of accepting it or not. It will often happen that when a practice is insisted on by law, and penalties attached to its infraction, no resistance will be made; whereas if the people are aware that there is no law, and no means of enforcement, their opposition will be most pertinacious, and if they can only hold out long enough it must be effectual.

It may be said that in some of the Bombay provinces a new Standard (referred to in para. 55) has been introduced with success without legal compulsion. That a reform in the *Weights*—that is, selecting the best known of those already in use—has been partially carried out by the personal influence of some energetic magistrates, is no doubt the case; but as regards the *Measures* of Capacity, a most important branch of metrology to the people of India, the attempt has only succeeded apparently, in one or two instances; and to show how little is to be expected from the progress of education, and march of intellect, the reform has been found impracticable (there being no *law* to enforce it) in the towns of Bombay and Surat, where it might be supposed that official influence and educational enlightenment would have aided the desired object.*

Even in those cases where the shopkeepers are *said* to have adopted the new Weights and Measures, assertions are not suf-

* The total failure of the late Municipal Act, in the Madras Presidency, may be cited as another instance of the insufficiency of a non-compulsory Enactment to effect social reform, however needed.

ficient. To my own knowledge, when the subject was under investigation at Madras, Reports were received from two Districts, most positively asserting that the Government Standards were in use ; but on subsequently *sending for* Measures actually used in the bazaars, it was ascertained that the Civil authorities had been misinformed completely. The statements of Native subordinates cannot be depended upon in these matters, and they err often from sheer ignorance ; if it is wished really to ascertain whether certain Weights and Measures are in use, the magistrate must not hear with his ears, but see with his eyes, and nothing less ought to satisfy Government.

Having thus given my reasons for believing that it is hopeless to expect a reform of so great a magnitude as uniformity of Weight and Measure throughout India, without some Legal enactment, I would not be unmindful of the fact that great caution would be requisite in carrying out that object. No Government should promulgate any law which it is not able to enforce, or any which cannot be enforced without oppression and tyranny. For these reasons, the enactment of a compulsory law as regards uniformity of Weight and Measure to take effect *all over India*, and *at once*, would be highly objectionable. It could not be enforced at all in remote and thinly inhabited districts, and in many localities where it *could* be enforced, the advantage to be derived from it would not compensate for the inconvenience and annoyance resulting from its compulsory introduction. I would therefore advocate a movement to be made determinedly, but gradually, both as regards place and time.

The enactment might be made applicable in the first instance, only to the towns of Calcutta, Madras, Bombay, and Agra ; to all Military Cantonments and to such towns as the Government of each Presidency might think fit to recommend ; and a distant but distinct date (say one year prospectively) should be fixed for the commencement of its operation.

By limiting the immediate action of the law to the principal Towns and Cantonments, its enforcement will be practicable, and benefit to be gained, sufficient to justify the employment of what may be to some an unpalatable exercise of authority. It may be

reasonably expected that the people of the interior, in their traffic with such Towns and Cantonments, will gradually acquire a knowlege of, and a convenience in conforming to, the Standards ; so that in a further period of time, the local operation of the law may be extended. As regards the Towns and Cantonments specified, there will be time beforehand for the people to make themselves acquainted with the new standards, to prepare new sets of Weights and Measures, and arrange their prices accordingly. During this period also, every assistance and encouragement should be given by the officers of Government to those who are likely to be inconvenienced by the measure. " Suaviter in modo, fortiter in re."

All Government transactions, accounts, tariffs, &c, should be in terms of the new System, and in every purchase made by the Public Departments, their own Standard Weights and Measures should be employed. This would supersede the attempts (always futile) to specify on every occasion, in equivalent terms of the authorised standard, the ever varying and uncertain values of the Native Weights and Measures. For general purposes, and as a guide to the Departmental officers, Tables of equalization should be prepar- for each District, showing the *average* results of experiments made to determine the value of the local Weights and Measures. Such Tables though useful, will not of course be conclusive in every case of purchase, inasmuch as Weights and Measures differ in different villages, and the Tables can only give the result of the average of the District. Such Tables have been lately compiled in the Presidency of Madras.

In order to prepare the people for the reception of the new Standards, not only should they be enforced in the chief Towns, and used in all Government transactions, but they should be explained in all the Government schools, vernacular tracts on the subject should be freely distributed, models should be kept in store in all public offices (both for ascertaining the true equivalents of the Native Weights and Measures, and to enable those who wish to take copies), and it should be constantly and publicly notified that the operation of the Act would be eventually extended to every bazaar in the country. The Chambers of Commerce, and the Railways and other Companies, should be urged to co-operate, even in

localities where the Act did not as yet apply, and if the Metrical system adopted, be one which conforms to English Weights and Measures, compliance would be the more easily afforded.

The Enactment should authorise only *struck* Measure, without making heaped measure actually illegal. By clause 7, Act 5th and 6th, Wm. IV. cap. 63, all bargains, sales, and contracts made by the heaped measure are declared null and void : and every person who sells any article by the heaped measure, is liable to a penalty of £2. Considering the repugnance of the Natives of India to struck measure, it would not be advisable at present to make such stringent provisions, but it should be distinctly notified that the system is adapted only to *struck* measure, that no purchaser has a right to demand any other, and that in any suit or action, where Measures of Capacity are called in question, the law will recognise none but *struck* measure. It will also be of importance carefully to explain to the Native trooops what the new Weights and Measures are, and that none but *struck* measure will be recognised in rations or allowances.

With regard to dealings in *grain*, there is no doubt that *weighing* is a more accurate test of value than measurement, but the latter is so much more expeditious and convenient, that it will always be resorted to by the Natives of India, especially as long as the present rudeness of their Balances remains unimproved. In England and Ireland, corn is always sold by weight in the wholesale transactions of large Towns, and many of the difficulties that occur in the Grain Contracts of the Indian Commissariat would be obviated, if their purchases were made by weight. The sale of salt by weight, in the levy of the Excise, should also be insisted on.

Magistrates should be empowered under the new Act, to appoint Inspectors, but no penalties should be inflicted except where the Weights or Measures were tested in the presence of the Magistrate, or his Deputy, and it would be well to deal leniently in all cases where there was no wilful error, fraudulent intent, or repetition of offence.

It may be expected that when the time comes for enforcing the operation of the Act, some attempt will be made in the large towns, to resist it, by a combination of the grain dealers to close their shops as has been tried on some occasions with success. Provision for this should be made in the Act.

It should also be considered how far Government should endeavour to relieve the shopkeepers and others, of the expense of procuring new Weights and Measures, by making them up in the Arsenals, and selling them below cost price or taking old Weights and Measures in exchange. In England the Parliamentary Committee of 1841, stated that it would cost the Government about £200,000 to make new *Weights* alone, but they considered it would be worth the expense.

There will be other details to be considered and embodied in the Act, which may be left for future discussion: such as the stamping of Weights and Measures; the using of Casks, Bottles, Jugs, &c. representing some defined Measure; the material with which Weights and Measures should be made; what articles should be sold by weight only; rules as to the publication of Price Lists; duties and powers of Inspectors; amount of fines and forfeitures, and mode of recovery; periodical re-verification of stamped Weights and Measures, &c.

In concluding this Paper, I would wish it to be understood that I do not presume to set forth my individual opinion as at all decisive. My object is, to obtain for so important and complicated a subject that careful consideration which has not as yet been conceded to it, and I would venture to express the hope that the Government of India before finally deciding on a Metrical system, from which if once promulgated they cannot retract, will obtain the opinion of persons in all the Presidencies, interested in the subject, and qualified to enter into it *in detail.* To those who are inclined to take the subject into consideration, I would submit that the question is not merely which is "per se" the most correct system of Metrology, but which is best for India; and that the essentials to be *combined* if possible, are I. The preservation of some standard of Weight and Measure common to the whole of India. II. The adaptation of the Weights and also the weight of *water* contained in the Measures of Capacity, to the current coin of the country. III. A definite but simple proportion (without fractions) between the Weights and Measures to be now introduced, and those of Great Britain. It will also be necessary to bear in mind that the *coinage* of India is not decimal, and there is no intention of changing it.

Memorandum by Mr. Bate, being an Enclosure in a Letter from the Court of Directors of the E. I. Company to the Government of Madras, dated 6th July, 1829, on the occasion of forwarding Standard Weights and Measures in accordance with Act 5, Geo. IV. cap. 74.

TABLE I. [Thermometer]

Temp. Fahr.	Grains to add or deduct.
55°	+ 25·30
56	+ 22·46
57	+ 19·36
58	+ 16·00
59	+ 12·38
60	+ 8·56
61	4·38
62	— 0·00
63	— 4·62
64	— 9·49
65	— 14·60
66	— 19·94
67	— 25·52
68	— 31·33
69	— 37·38
70	— 43·63
71	— 50·06
72	— 56·69
73	— 63·52
74	— 70·55
75	— 77·78
76	— 85·21
77	— 92·84
78	— 100·67
79	— 108·70
80	— 116·93
81	— 125·36
82	— 133·99
83	— 142·82
84	— 151·85
85	— 161·08
86	— 170·51
87	— 180·14
88	— 189·97
89	— 200·00
90	— 210·23
91	— 220·66

At a temperature of 75° Fahr. a Gallon of distilled water weighs 77·78 grains *less* than 70,000 grains. Or 70,000 grains — 77·78 grains = 69922·22 grains.

TABLE II. [Barometer.]

Barometer Inches.	Grains to be added or deducted.
·01	·0246
·02	·0492
·03	·0738
·04	·0984
·05	·1230
·06	·1476
·07	·1722
·08	·1968
·09	·2214
·1	·2460
·2	·4920
·3	·7380
·4	·9840
·5	1·2300

Ex. Suppose the Barometer at 29·54 inches. (*below* 30°)

·5 = 1·2300
·04 = ·0984

1·3284 grains to be *deducted* from the Gallon of 70,000 grains.

If the Barometer is *above* 30 inches, the grains are to be added.

The following Abstract adapted to lbs. avoir. and to Tola (or Rupee) weights, has been prepared from the above.

Temp.	Grains of water in 100 cuibc in.	Diff. in grains.	Avoir. lbs.	Tolas.
80°	25203·6		3·6005	140·020
81°	25200·6	3·0	3·6001	140·003
82°	25197·5	3·1	3·5996	139·986
83°	25194·3	3·2	3·5992	139.968
84°	25191·0	3·3	3·5988	139·950
85°	25187·7	3·3	3·5983	139·932
86°	24184·3	3·4	3·5978	139·913
87°	25180·8	3·5	3·5973	139·894
88°	25177·3	3·5	3·5968	139·874
89°	25173·7	3·6	3·5963	139·854
90°	25170·0	3·7	3·5957	139·834
91°	25166·2	3·8	3·5951	139·812
100°	25129·0		3·5899	139·600

IX. *The Study of Living Languages. By* Colonel Arthur Cotton, *Madras Engineers.*

The learning of the living languages of foreign, semi-civilized, and savage people has now become a matter of such immeasurable importance that any man may be excused who makes the poorest attempt to diminish the difficulties of such a work.

Englishmen especially, are at this moment employed by thousands, as Merchants, Missionaries, Magistrates, &c., in learning hundreds of different languages spoken by people in all stages of civilization, from the lowest state of society upwards, and in their speedy acquisition of a correct knowledge and free colloquial use of several tongues of those tribes, hundreds of millions of the human race are most deeply interested, as that upon which mainly depends both their temporal and eternal interests. Yet I am not aware that there is in existence a single work in which this subject is closely and systematically investigated. It must be observed that the point before us is, what is the best mode of acquiring a knowledge of the language of savage and semi-civilized nations? and that this is in some important respects quite distinct from both the acquisition of dead languages and also of the living languages of nations who have been fully civilized and, consequently, have a complete system of literature, a great variety of books of instruction written by extensively informed Natives and also thoroughly educated teachers.

There are difficulties in learning the languages of semi-civilized and barbarous people which do not exist in the case of the languages of civilized nations, and with respect to the dead languages the principal points to be attended to and the objects aimed at are so entirely different from those in living languages, that what is applicable to the one is almost entirely inapplicable to the other.

Nothing can be more deplorable than this state of things. The mischiefs arising out of it are incalculable. All, without exception who require to know such a language, and who make attempts to acquire it, lose, probably from three fourths, to nineteen

twentieths of the time so employed; a large portion lose the whole, breaking down before they have acquired any useful knowledge at all; probably scarcely one in ten acquires a tolerably correct and free use of it, and scarcely one at all such a knowledge as to make them really effective translators, an office of the highest possible importance, because the transference of English literature, for the great mass of the inhabitants of the earth, must precede the formation of a national literature among each tribe.

At present it may safely be said that no system whatever is followed in studying such living languages for colloquial purposes. Let any one individual of the thousands who are at this moment so employed, be asked, whose system of study do you prefer, or have you any of your own, and upon what grounds do you decide upon this, or that point, and his answer would generally be such as to show that he had no clear, definite, well-digested ideas on the subject. Without the least previous investigation of the subject, without spending one single day in reading a treatise on it, or considering it in his own mind, he usually blindly takes in hand a matter upon which he will perhaps employ one or several years; taking at a venture as it were, any books or teachers that he may happen to fall in with, or any ideas he may happen to have got into his own head, he knows not how or whence; without any solid grounds for concluding whether the mode he is pursuing will lead to an economical or an enormously wasteful expenditure of time, and, what is of more importance, whether he is laying the foundation of a real, correct, and effective knowledge of the language, or establishing himself in a totally false use of it, which, when become habitual, will never be corrected.

Matters are in respect of this study of languages just as they were in respect of road making before the time of Mr. McAdam. Every man thought he was born a road maker, and those holding the charge of roads did almost anything to them and called it repairs. It was a most common thing for instance to throw a thick layer of loose rounded gravel on the road, which at first caused almost the greatest possible resistance to the carriages and by degrees was converted into mud, but never afforded any thing ap-

proaching to a clean, hard surface. The road menders were quite satisfied because they were doing something, but if asked, why they did what produced an effect exactly the opposite to that which was desired, they of course could not have given a reason. Road-making has since been thoroughly investigated and though men have not yet perhaps found out the best way of doing it, they have now a real reason for what they do, and consequently a prodigious improvement in roads has been produced.

It is high time that such a change should take place in reference to this subject now before us, and any attempt at an examination of it, with a view to a really sound system of study should be accepted.

The thoughts contained in the following paper are the results of such a consideration of the subject as could be given to it in the midst of duties of another kind during a period of more than thirty years.

Circumstances have not allowed of the writer following up the study of any language, to any extent, having repeatedly moved, from where one language was spoken to where another was used, and his time being too much occupied with pressing business; nor has he had an opportunity of commencing the study of a language with such materials, as he here recommends, ready prepared to his hands.

In the course of this long period however he has had an opportunity of trying his plans partially in several languages both on himself and others, and thus of correcting in some measure his first ideas and forming something like a digested system in his own mind; and he must state that as to the leading points in the system here proposed, he has quite satisfied himself.

He has taken every opportunity of obtaining aid from others, both by reading works of teachers of languages in Europe, and also by trying to discuss the question with those who were studying and had studied such kind of living languages. From the former he has received some help, though often merely by being taught what to avoid; but from the latter he received no assistance,

simply because in general they had no distinct ideas at all on the matter, nor any solid reason for any thing they had done in their studies. He has however got various hints from observing what progress different men had made in such studies when using different means. On one occasion he met with a young man who had given his whole time to Arabic for three years, and could not then produce a sentence in conversation, and soon after he was intimate with another who in about 8 months and while loaded with other duties, had obtained, if not an accurate yet such an *effective*, colloquial use of the same tongue, that he regularly transacted extensive business in it with strangers of all sorts without the least difficulty. Again, in India one meets every day with men who have studied most diligently for one, two or three years, and yet all their life after speak a language, that both from pronunciation and expression is almost, or quite, unintelligible to any Native, excepting those who from being about them constantly in an official capacity have *learnt their* language, (for what they used and called the Native language was really a language of their own invention) and so have come to understand them.

The writer cannot conclude these remarks without expressing his full assurance that the acquisition of a correct knowledge and perfectly ready colloquial use of such languages will be found to be a matter requiring very little time compared with what it does at present, in most cases, when a better mode of learning is adopted. On one occasion he had an opportunity of observing the progress made by children in acquiring a new language in a certain time. Out of a number that embarked in a ship in India many did not know a word of English, having previously used nothing but some Indian language, and they were of various ages. During the four months of the voyage to England every one of them had so perfectly acquired the use of English that they never were at a loss, and latterly seemed to have as good a knowledge of it as those who had always used it. Now if children of a few years old, without the slightest assistance from teachers or study, could thus pick up a colloquial use of a new language in four months and talk it exactly like one who had never talked any thing else,

it seems certain that adults with a hundred times their power of mind and with suitable books and teachers and regular study could not fail to attain to a real knowledge and ready colloquial use of a new language, and that without being years about it, unless they were altogether wrong in the method of study they adopted. In fact he cannot help declaring it as his opinion that when this subject is fairly grappled with by men, the great supposed obstacles to intercourse of strange languages will be found, comparatively speaking, a mere bugbear; and that the acquisition of a new language for all the ordinary purposes of life will be found to be within the reach of almost all with a comparatively very small expenditure of time and labour.

Before proceeding to propose a system of study of living languages, it may be well to make some remarks on the mistakes that are commonly made at present, and the chief difficulties that are usually met with, as well as on the time generally expended on such study.

A great many of the common mistakes can easily be traced to the circumstance that almost universally the students have previously been accustomed to study dead languages, and from their not observing that almost all their ideas have been formed from *that* study, while the principal points to be attended to in the study of living languages are exactly those that are of little or no consequence in that of dead ones, and *vice versâ*. In learning Latin or Greek, for instance, the sole objects usually are to be able to read so as to understand the writings of highly educated men and (but as very secondary) to write elegant formal essays. The following are therefore the leading points aimed at;

1st. A knowledge of the character.

2nd. A knowledge of the whole vocabulary of the language, including a multitude of words seldom or never used colloquially in the ordinary business of life.

3rd. A readiness in perceiving the meaning of long involved formal sentences, such as are found in grave prose and in poetical writings.

4th. A thorough knowledge of the whole grammar, so as to be able to give a formal rule for any thing when questioned.

5th. And such a familiar knowledge of the idiom of the language as will enable one to write formal papers in a good style.

The points that are of little or no consequence are,

1st. Correct pronunciation.

2nd. An extensive knowledge of the common expressions used in the ordinary business of life.

3rd. A perfect readiness at recognizing the word by the sound when rapidly spoken.

4th. The same in forming sentences to express our own thoughts.

Now, if we consider these things we shall perceive that the study of the dead languages and that of the living languages of semi-civilized and barbarous nations are almost diametrically opposed in respect of the objects to be attained. The points that are essential in the one are either non-essential, or of no importance whatever in the other and *vice versâ*. A man may talk a language most fluently, correctly and usefully, for all the ordinary business of life, without knowing the character, without being able to quote a single rule of grammar, without the knowledge of half or three-fourths of the vocabulary of a language, and without any facility in comprehending the involved sentences of formal writings of learned men ; while, without an accurate pronunciation, an ample acquaintance with the common colloquial expressions of uneducated people, and a most free and ready use of them, so that strangers can readily catch his words and comprehend his meaning, and without an ear thoroughly exercised in the sounds of the language, so as at once to recognise what is spoken by a Native, he has entirely missed his object, though he may know every word in the language and every rule of grammar, and be able to write an elegant essay without a mistake. Books of history, &c. do not furnish us with the expressions of ordinary conversation. *Every country has its own peculiar forms and they must be learnt individually ;* no rules can be given by which a student, who knows the words and grammar, can invent them himself. In semi-civilised countries, where not

one in a hundred has read books, there is a large proportion of the words, which are never used in conversation on ordinary matters, and which therefore are so far from being of any use to the great mass of those who have to acquire the language that they are always in his way, if he has learnt them, leading him to express himself in words not in common use, and consequently unknown to most of those with whom he has to communicate. So far therefore from it being sufficient to follow the ideas which a man has gathered while studying dead languages, they are in fact the very opposite to those which are correct as respects the study of such living languages as are here supposed.

If we examine the mode of study adopted generally, however it may vary in minor points, the system, so far as that can be called a system, which is indeed no such thing, is that suited to the dead languages. A man takes up a book of stories, a grammar, and a dictionary, and learning, almost exclusively by the eye, he proceeds exactly as if the use of his ear were of no consequence, as if he must at once grapple with the whole vocabulary of the language, and as if when he had got the materials of words and rules of grammar, he could himself guess the forms of expression which he must compound from them; like the idiot who was found to have stored up in his box all the wheels, axles, &c., he could lay his hand upon, thinking that when he had got enough he could easily make a clock of them. The results of this-proceeding are notorious. A youth in India has passed a splendid examination, knows every word of the language and has a rule of grammar for everything, loses his way out riding and cannot get home before he is in danger of a stroke of the sun, because he cannot make any Native he meets understand him, nor can he understand a sentence spoken by them, and this after many months, often a year or two, of intense study from morning to night. And what is still worse, probably he is confirmed in a false pronunciation and a false mode of expression from having almost entirely neglected these two great essentials, or at least not having given them any thing like due attention. The consideration of this source of many of the most serious mistakes that are made in this study will be very useful.

Another great source of mistakes, is that such languages are

generally learnt by men at that age when they have most confidence in their own powers and when they are consequently always disposed to take the bull by the horns. With this feeling the student generally rushes into the midst of his enemies headlong, attempting to grapple at once with the character, the pronunciation, the whole grammar, the whole vocabulary of 20,000, or, as in Arabic, 200,000 words, the language of books and the language of conversation, &c. No wonder that such a one finds himself continually discouraged, that many give up in despair, that all waste an enormous amount of time and mental effort, and that scarcely one in a hundred ever talks like a Native. Whatever a man's powers may be it is certainly sheer waste to set about matters in this way, and he cannot possibly receive such clear impressions on his mind as the same person would, if he concentrated his attention upon one thing at a time.

It may also be well here to advert to some peculiar difficulties which we necessarily encounter in the circumstances in which Europeans are ordinarily placed in semi-civilized countries, and especially in a country like India, in which caste prevails. If an Englishman wishes to learn French or German, he can go and live with a Native family, or throw himself continually into the society of Natives, in inns and places of public resort, where his ear wil be exercised from morning to night in the true pronunciation and the real ordinary expressions of the language, and where consequently, without the least effort even, though indeed slowly, he can hardly help acquiring a correct use of the language both as respects pronunciation and expression. But there are few countries out of Europe where a European can thus freely associate with the Natives, and in India he is effectually excluded from their houses. Separate and special means must therefore be used, to exercise the tongue and ear of the student, and to store his memory with a stock of bonâ fide expressions.

Another difficulty is the great inferiority of Native Teachers compared with European Masters. Indeed in a great proportion of cases a man has to learn a language with the assistance of one who is not a teacher at all by profession, and who therefore can-

not give him a hundredth part of the help derived from a practised and well instructed teacher. Further, such languages are so extremely different from the European tongues, in every respect, that a person is much more likely to be discouraged from the difficulties he experiences than in learning a foreign European language, and on this account it is especially necessary to adopt a system that shall as far as possible tend to *keep up the student's courage.*

These are some of the leading points that should be kept in view in considering a system of study for such languages.

I would now propose some fundamental principles to be taken as clues to the better understanding of the subject.

It is evident that there are two fundamental points to be attended to. The first, which is by far of the greatest importance of the two, is ; To be careful that we lay a sound foundation. This is a universal principle and yet one at least as often forgotten in studying languages as in other matters. If a false foundation is laid, the erection can never be made sound. If a man once acquires a false pronunciation or a false mode of expression he will never get over it. Whatever he learns should be perfectly correct, and not only so, he should have such a thorough knowledge of it that he shall be fully assured in his own mind that his knowledge is correct, so that he may not afterwards be in doubt and liable to give up what is right and substitute some guess of his own instead. For want of right modes of study, what numbers use all their lives some language and pronunciation of their own invention. and never find out how it is they can hardly have any intercourse with Natives by means of it. The true *value* and true pronunciation of every word encountered should be fully ascertained, and its use in a great variety of forms of expression should be made thoroughly familiar, before proceeding to other words, and no imperfect acquaintance with a word or expression should be allowed. The second great principle is of course ; To save time ; but this must always be subordinate to the former. In the main however the two principles are not only compatible but inseparable : nothing causes so much waste of time as imperfectly learning things, receiving indis-

tinct and shallow impressions of them, because such things are always forgotten and have to be learnt over again. This is the grand reason why such enormous time is wasted in this study. A man attempts so much at once that every thing is partially learnt and forgotten probably at least a hundred times over. He begins with a book containing hundreds, more likely thousands of words and long sentences involving innumerable rules of grammar, and before he gets to the end of it has learnt in a sort of way and forgotten every word in it and every expression over and over again, and has probably in the end thoroughly apprehended and acquired a familiar knowledge of not one twentieth part of the words he has met with. He perhaps makes lists of the words that he meets with and learns many hundreds by heart at once, but he has no useful knowledge of one in twenty of them. No word is effectually known till it is so thoroughly familiar, that it is ready in his mouth at any moment, without the slightest effort of memory, and till it can be used in a considerable variety of expressions; in fact, till it is just to the student like one of the words of his native tongue, and so wrought into his mind that it cannot be forgotten again. It may however often appear that time would be gained by adopting some plan which would endanger the soundness of the foundation, and in this case such a plan must be rejected.

The third great principle is; To have such a system as shall encourage people, both to commence upon and go through with the study of Native languages. It is of exceeding importance to encourage all persons, whatever their situations or occupations are, when remaining for any time however short or uncertain in such countries, to make themselves acquainted, as far as possible, with the language of the people. Numbers at present never attempt it, solely because the usual mode of study cuts them off from all hope of ever attaining to the smallest useful knowledge of it, without such an expenditure of time and labour as they are afraid to encounter or their circumstances absolutely prevent. A system which shall afford some useful results to every one who enters upon it, and those in some degree proportioned to the time and labour ex-

pended, is an immense desideratum. It would lead numbers to make a beginning who now never attempt it; and many such, if they once began, would not rest till they had obtained some considerable knowledge of it.

An encouraging system is equally required for those who do at present set themselves to the study with the purpose of going through with it. Nothing can be more discouraging than the means usually pursued at present, whereas if a man were pursuing a system in which he felt at every step, that he was making real useful progress, he would go on with tenfold spirit, always feeling too, that stop where he would, his labour had not been thrown away. In endeavouring to accomplish the first object the following rules may be laid down.

1st. The student is really to *learn* the language and not to attempt to *teach himself*. For instance, nothing is more common than for a man, as soon as he has learnt a few words, with the help of his grammar to begin to try and form sentences. In this way he may certainly make a new language of his own, but it will not be the language he proposes to learn. Thus numbers attempt to communicate with Natives by English sentences made up of foreign words which consequently are not merely scarcely intelligible but often convey no meaning at all, though perfectly correct as regards both words and grammar. The student must not at first attempt to take the smallest step alone. He must not pronounce a word nor put two words together by himself. He must be content to *learn* every thing, and that thoroughly, from a Native, sound by sound, word by word, expression by expression, and not attempt to go beyond this, till he has become so established in correct pronunciation, in his knowledge of the correct value of words and in the actual forms used by the Natives that there is no danger of his substituting something of his own for the real language.

It is by no means sufficient to learn a sound or expression once or ten times: it can only be correctly acquired by exercise, by thousands of repetitions, referring every time immediately to a correct standard. If a man reads for an hour with a teacher and then goes attempting to pronounce the words by himself for the rest of

the day, he will inevitably acquire a false pronunciation, unless he is so thoroughly established in a correct pronunciation that there is no danger of his losing it and then indeed abundant exercise of his tongue, when alone, will be of the utmost use, but this at first is ruinous.

Suppose a child were shown the form of a letter and then as soon as he had a rough idea of it should go on writing repetitions of it without a standard before him, any body can tell what would be the consequence ; at the end of a month he would be thoroughly confirmed in writing such a letter as had never been seen before ; and if he had occasionally the standard put before him, the consequence would be that nine-tenths of his time would be passed in learning to recede further from the original, and the other tenth in trying to get rid of the habit of writing wrong and to bring himself back to what was correct.

The same is the case with the student of languages, and in general they are thus constantly employed in partially learning and then unlearning, and the consequence is that even where an approach is made to a correct use of the language nine-tenths of the time employed is needlessly lost.

A third point is to learn one thing at a time.

If a number of things are pressing upon the attention at once, it is impossible that a distinct and permanent impression can be received by any mind whatever its powers. Let us consider a person learning a language in the way so commonly followed. He is grappling with a sentence of many words. Here he has at once to consider the character, the meaning of many new words, the pronunciation of them all, the inflexions of the nouns and verbs, the syntax, the mode of expression, &c. The consequence is, his attention is so overwhelmed and distracted that his mind is incapable of receiving a clear impression on any one point. No wonder that so little progress is made, that the knowledge acquired is so imperfect and incorrect, and that the student is so constantly discouraged. Often his progress is one continued effort to bear up against the most depressing feeling that he can never master the difficulties, as a man wears himself out sometimes in trying to carry a load be-

yond his strength, when if he would divide it and carry a portion of it at a time, he would not only accomplish his task and that comfortably, but would gain strength by the exercise. How many especially in hot climates are so injured in their health, not by learning a language, but by the way in which they learn it, that when they have some use of it they are obliged to lay by for a time. Whereas if they would learn one thing at a time, they would attain to such a clear and sound knowledge and go on so comfortably that they would be in no danger of ending without an effective use of the language.

A fourth point is to take care to give the whole strength to the really essential parts of the subject. What are the things that constitute a sound knowledge in this case? Certainly not a loose imperfect idea of the value of almost all the words of the language, with a rough guess at their pronunciation and the mode of putting them together, the power of reading the character, of understanding a book with the help of time for consideration, of recognizing the words by sight, &c. This is the foundation that is usually laid; such a student now commences to apply his knowledge of the language to the principal, perhaps the only purpose for which he has studied it; viz., conversation. He finds of course that his being able to recognize the words when he sees them is of no use to him; he has no facility in recognizing them by the ear, which was the only thing he required; he says the Native, he is attempting to talk with, speaks too fast. The fact is that he has not been learning the one grand thing he had to learn, the use of his ear. Next, he finds his knowing all the words in the language, in a certain way is of little or no use to him, because what he needs is the perfectly ready, familiar use of one in ten of them, but he cannot put a dozen together in that ready way which is necessary for conversing.

Next, when he has with much difficulty put a sentence together he is paralyzed by seeing a civil, enquiring stare on the countenance of his companion, in consequence of the imperfection of his pronunciation, and the English mode of expression he uses. His failure usually produces utter discouragement, unless he has such

a good opinion of himself that he attributes it entirely to the stupidity of the Native. In reality he has been giving the whole of his attention to matters that are of little or no use to him, while he has almost entirely neglected those that are essential.

This brings us to the fifth principle, that *the language must be learnt by the ear and not by the eye.* This is one of the great fundamental mistakes made almost universally in studying living languages: the student never for a moment studies without seeing the words, though he knows that his whole object is to recognize them by his ear, without any assistance from the eye. A man might just as well attempt to train himself for a walking journey by sitting down for a year and turning a winch with his arms, or try to strengthen his limbs by moving for 6 months on crutches. Every body knows the consequence of this system, but every body pursues it. From the first the ear must be the main medium of receiving instruction and though the eye may be used a little at first with some advantage just to help the memory, yet after a little time the ear should be employed alone in conversation.

A man may consider he has laid a sound foundation when he has made the following acquisitions.

1st. The perfectly accurate pronunciation and thoroughly familiar knowledge of a certain number of the most generally used words, however small, so that they are to him exactly as words of his own language, that is, that he has not to search about in his memory for them when he wants them, but that they will come of themselves, and these pronounced so that a Native cannot but recognize them.

2nd. The power of putting these together in a good number of real bonâ fide Native expressions, however short, without any effort, expressions which he can confidently use, because he knows they are real, as he actually learnt them from a Native, and not ones that he has invented and which consequently may or may not convey the meaning he intended or any meaning. One will often hear a Native who has learnt English at a school use a sentence which is unexceptionable as to grammar, &c., but which is objec-

tionable as conveying no meaning whatever to an Englishman. Thus a Tamil man may say in English, "If you see this that is good," and the Englishman to whom it is addressed cannot even guess what he means to express, though the same expression conveys a clear idea to the Tamulian.

3rd. An ear so exercised in the sounds of the language that the words spoken by a Native, if they have been learnt, are at once recognized by the student so that what is said within the limit of the student's vocabulary can be apprehended at once without seeing the words written, and without a moment's consideration.

4th. The knowledge of so much grammar as is necessary to form sentences of a few words only.

This is the sort of knowledge of a language that a child of three or four years old has. He does not know a single rule of grammar he cannot perhaps read or write a letter, his whole vocabulary probably consists of a thousand words, but within the limits of the matters he has to converse about, he can say with perfect freedom and almost perfect correctness any thing he wants without a moment's hesitation, and he understands on the instant every thing that is said to him, and that even though some of the words used are unknown to him. He has in fact a sound foundation, what he knows is real, and he has only to go on adding to his stock of words and expressions, and to correct some unimportant errors, which however are such as do not in the least prevent his being understood. An adult student, who has such a knowledge, is in a right position, because he can converse within certain limits, and therefore he is in the way of exercising himself *in contact* with a correct standard, and he has nothing of consequence to unlearn; his progress is not stopped by established habits of false pronunciation, and false expression, nor by habitual dependance upon his eyes to assist his memory. His only care then in conversation should be, not to attempt too much, but to content himself with common subjects and simple expressions, and only giving himself more liberty, as by learning he increases his stock of words, expressions, &c. The knowledge of the character has nothing to do

with this foundation, it is not in any way an assistance in acquiring it, and it is a great hindrance. A child uses his language freely and correctly without knowing a letter. *The character has no connection with the pronunciation of a language*, which must be learnt by the ear alone, and the sounds so acquired are just as well represented by the student's own letters as by any others. Neither is a knowledge of almost the whole language necessary to it, the words in common use about ordinary matters form only a very small proportion of the words of a language, and three-fourths of the words which occur in the books ordinarily read are of no use whatever to the beginner; they are on the contrary the greatest hindrance to him by preventing his thoroughly learning those that he ought to have a familiar use of. Let us recapitulate the things necessary to form a sound foundation.

1st. A small vocabulary thoroughly known and become as familiar as the words of one's mother tongue.

2nd. An accurate pronunciation of these and the organs of speech thoroughly exercised in them, so that they can be spoken with perfect freedom.

3rd. So much grammar as is necessary to put these words together in short simple forms of expression.

4th. An ear so thoroughly exercised in the sounds of the commonest words as spoken by a Native that they can be instantly recognized when *heard*.

5th. The knowledge of a considerable stock of the commonest expressions of the language, so that the words known can be made into bonâ fide sentences.

When such a foundation has been laid, the student has only to proceed to add more words, more grammar and more expressions by degrees, only taking care to learn nothing but what is immediately wanted and to learn thoroughly whatever is learnt at all. When considerable progress has thus been made, he may proceed to learn the character if he requires it and to read books, &c.

Let us now consider more particularly the second main point, viz., to save time.

As in other matters, the right way of acquiring a correct knowledge of a language will be found to be suitable for the attainment of this main object also.

The things that are necessary to ensure a sound foundation are equally so to secure the saving of time; but we will now consider the details especially with reference to the latter. The first thing then is, to do one thing at a time. Surely this is a principle that will at once commend itself to every one. We have to learn the character, the words, pronunciation, the grammar, the expressions, &c. Our plan therefore should be as far as possible to separate these, and have the attention concentrated upon one of them at a time. This certainly cannot be fully accomplished; but it can be sufficiently, for practical purposes.

The second is, to learn thoroughly whatever is learnt. How can there be any question about the waste of time produced by partially learning things and so forgetting them over and over again? We may safely say that, as ordinarily studied, the meaning of every word, its pronunciation, points of grammar, expressions, &c., are partially learnt and forgotten again hundreds of times over. Everything that is learnt should be so followed up that it may be indelibly fixed in the memory and be as much part of the student himself as any thing in his own language.

Thirdly, learn only what is really wanted. Surely this also is most obvious. To learn at first words which will either never be of any use to him, or not till he is far advanced in the language, is entire waste of time. The same with forms of expression, &c. An Englishman never thinks it necessary to learn all the words of his own language, he never knows half of them, much as he reads; and how many must there be in every language that he need never know. The student should first begin with such words as are of universal use in common life and then, when he has made some progress in the language, commence upon those which are necessary for his particular profession. Even in English there are numbers of words which, though common in books, are never used in ordinary conversation; but this is much more the case in languages in which ninety nine hundredths of the people scarcely ever read a

book at all. To the beginner such book words, as he cannot distinguish them from others, are nothing but a serious hindrance to him.

Bishop Heber remarks that to make himself intelligible to the great mass of his hearers who were uneducated persons, he used to find it advisable to confine himself as far as possible to words of Saxon-derivation, that is, to words commonly used in conversation. If such a precaution were necessary in England, how much more in semi-civilized countries.

Can there be any question but that by a system of study based upon these principles, by far the largest part of the time usually spent upon acquiring a colloquial use of a foreign language may be saved. Look at the progress a child makes in a really useful knowledge of a language, whether his first, or one picked up afterwards, from being associated with those who speak it, with such extremely small powers of mind, without any effort, and without any materials. Can it be supposed that an adult with such enormous advantages, with properly prepared materials, and with diligent study could not make much more rapid progress, if he pursued a right system.

The system that I would now propose, founded on these principles, is as follows:

1st. The language is to be learnt through the medium of the English character.

The object of this is to get rid of any thing which is not absolutely necessary to be learnt at first.

It may be said that it takes a very little time to learn the Native character; and so it does to learn it *in a certain way*, that is, so that by fixing the thoughts upon a letter and taking a little time for consideration, it may be recollected to represent a certain sound, but it will be a long time before the character is so familiar as not to occupy the attention most seriously, and that at the time when there is the greatest demand upon it. But not only is a known character preferable at first on this account, but it is also superior as a medium to the Native character, as being less liable to lead to mistakes. In an Indian language for instance, in which

there are two or three *n's* and as many *l's*, the beginner is always liable to forget which is which; but the plan of noting the sound by English letters with one or two dots under those that represent peculiar Native sounds, effectually prevents any such mistakes, the dots remind the reader in the readiest manner that they represent such sounds as are those upon which the attention should be especially concentrated. Every letter in the Native language must be represented by one certain letter of English, so that the proper spelling may be known. As to the learning of the Native character ultimately, if the student should require it, it is the easiest thing in the world when the language is known in other respects, and the whole attention is available for the letters only. The time required for this is most trifling but even were it considerable it would still be necessary to learn at first through the medium of the English character, on account of the enormous loss of time arising from having the attention overburthened at first. I therefore reject the Native character as being,

1st. Quite unnecessary for learning the language.

2nd. As being a most serious hindrance, absorbing a great deal of the attention, when its utmost efforts are required for those things which are essential.

3rd. As not being required at all by a great proportion of those who need to acquire a foreign language.

4th. As a thing that can be acquired with a hundredth part of the time which would be consumed at first, after the other parts of the study have been matured.

5th. As being more liable to be mistaken by the beginner than the English character.

If it be said, but how can it be avoided when there are no elementary books of the language in the English character? I answer, First, that I am here proposing a new system, and of course would have books prepared suitable to it; Second, that in many languages, as in those of Bengal, many books have already been prepared in this way; Third, that in many situations the student could, with the assistance of a Native, easily provide himself with the first ele-

mentary books, without much loss of time, and certainly with much less expenditure of time, than by studying in the common ways with such books as are already provided; and Fourthly, that if there is no alternative, we must of course begin by learning the Native character, but still if we follow out the other parts of the system here proposed, it will be much less a hindrance to him than to those who adopt the usual means, because he will seldom have to read any words but those which he knows, and then the strange character is comparatively a small hindrance. Of course, in applying the English character, the value of each letter must first be defined, as is now fully recognized as an essential principle, and which is always acted upon in the Bengal books. The letter, *A*, for instance, has in English seven distinct sounds as in the words, *hat, mast, all, many, America, Yacht, make.* In all the East Indian languages, the letter which represents the sound of our *A*, in *Mast* or long *A*, somewhat modified, represents the sound of our A in *amuse*, or short *A*, and therefore this letter, with and without a long mark over it, should represent these two sounds and be used whenever the corresponding characters are used or implied in the foreign word. With respect to the other sounds of it, some are unknown in certain languages, as for instance the sounds of that letter in the words *hat* and *Yacht* are unknown in any Asiatic language. No Native Indians can pronounce the words *hat* and *hot*, but are under the necessity of substituting some other vocal sound for them, till they have learnt the true pronunciation. The other sounds of it will of course be represented by those English vowels which more properly represent them, only taking care, to use the same letter to represent the long and short sound, distinguishing the former by a long mark over it. Thus the sound of *E* in *Hen*, and *Féte* which are properly the same sound pronounced long or short, are represented in the Indian languages by modifications of the same letter and should therefore both be represented by *E*. With respect to the sounds which are either unknown in English, or not represented by any one English letter, they should either be represented by a combination of English letters, if possible, or if not by a letter or letters, distinguished by a mark; as for instance one or more dots under them. There are, for instance, four let-

ters that represent in the Tamil language the sound of our *N*, or some modification of it; one, is precisely the sound of it, the tongue being placed in the same position as by us. This will be represented of course by our *N*. The second is the same in sound, though represented by a different character, but it occurs only when preceding and combined with a certain other consonant, this may also be represented by a simple English *N*, as the sound is the same. The third has the sound of *Ny* in English and therefore should be represented by those consonants, the sound is that of our *N*, in *New*. The fourth is a sound unknown in English: it is pronounced by the tongue being turned entirely back, so that the under part of its tip touches the roof of the mouth. An *N*, sounded with the tongue in this position is the sound required. This therefore should be represented by an *N*, with a dot under it, the dot or dots being the invariable mark of a sound quite strange to an Englishman, so as to be the readiest warning to the student that the tongue must be placed in a position which is new to him. This is much preferable to the Native character itself, because there can be no mistake about it without any effort of memory, whereas the foreign character will always require the student to consider which of the several sounds of *N* it represents.

It may be observed here, that, in general, probably in all cases, the languages of semi-civilized people that are written, have an invariable sound for each character, so that there is no such difficulty in representing them by the English characters as there would be in representing English by some foreign character, on account of the vocal sounds being represented in different words by different vowels; as, *Hat*, *yacht*, *many*, *all*, *&c.*, and *grief*, *leaf*, *seed*, *previous*, *Marine*, *receive*, *and homœopathy*. In writing English therefore in a foreign character, there would be no alternative but to use a certain letter for each sound, however that sound is represented in English writing, and correct English spelling must be learnt afterwards. But these difficulties do not exist in applying the English character to represent the sounds of most of the written languages of semi-civilized nations.

2nd. Begin with a restricted vocabulary. In the first place,

reject of course all words which will never be required, such as those used only in learned works: next, reject all those that hardly ever occur even in books. Next let alone those that are chiefly in use only in certain particular lines of life, and are more or less technical. Again, have nothing to do with any words that are not commonly used in the ordinary matters of life. What can be gained but clear loss by burthening the young beginner with a multitude of words, by far the greater part of those in the language, that will be thus rejected, when they have nothing whatever to do with his acquiring a useful knowledge of the language, and when, if required, they can afterwards be added in a tenth part of the time that they would require at first. Probably out of twenty thousand words in a language, the knowledge of 5,000 would set him so perfectly at liberty in all ordinary conversation that neither he himself nor those he converses with would be reminded that he does not know all. And if occasionally a person used one of the remaining words, probably he could not mistake the meaning of it in the midst of so many known ones. And if he could not perceive what it must mean, he could have no difficulty in asking the meaning or understanding the explanation. Having thus relieved our student from such a mass of useless labor, let us next divide these 5,000 words, or whatever the number is, into several portions, taking out first one thousand and then another of the least common and least immediately necessary words, till we have only a thousand left. Out of these we again take 250 three times and then 150 in the same way, so that to begin we have only 100 of the commonest words in the language, but consisting of all the different parts of speech so that little sentences may be formed out of them. The learner then deals with only one of these batches of words at a time, not troubling himself with the others till he knows the first batch as well as he does so many words of his own language. This is one of the great essentials of the system proposed. Words should never be partially learnt and forgotten again, nor imperfectly, that is, so that their true value and use are not thoroughly known. When once a word is taken up, it should of course be thoroughly secured both as respects the meaning of it and its use, and it must

be particularly observed that it is not the bare knowledge of a word that is wanted, so that a person by more or less thought can recall it to his mind, it must, to be of any use in conversation, be perfectly familiar, and it must have been repeated aloud so many times that the organs of speech have been thoroughly exercised in it, and that it may be pronounced both correctly and with the utmost freedom. Nothing but *multiplied repetitions of it aloud with continued reference to a correct standard, and in connection with various other words can accomplish this.* It must take some time thus to appropriate new words, and especially the first 100 words of a language, but the process cannot possibly be hastened, but on the contrary indefinitely delayed, by attempting thousands of others before the first are secured.

The number 100 is chosen for the first batch, as being about the smallest number that can enable one to make up some variety of short sentences, so that each word may be seen in a variety of situations and in its various inflections; and they are sufficient to provide for exercising the student in the first rudiments of grammar.

3rd. To each of these batches of words a set of sentences is to be added; these are all to be the commonest colloquial expressions. They should consist of a certain number written on each word in the batch, and contain no words that are not in it. It is essential that they should be written by Natives, and those who cannot speak English would be preferable, in order that there may be a security for the sentences being true Native expressions. It is also essential that the writers should not be highly educated men, but ordinary intelligent men of the middle classes, otherwise the sentences would be almost sure to be full of fanciful things. The list of words should be given to several different persons in order to secure a good variety of expressions, and some selection should be made. The first set ought not to consist of less than 1,000 sentences, that is 10 to each word, in order that by means of this batch of words the first rudiments of grammar may be quite familiar, and some considerable notion obtained of the general style of expression peculiar to the language, keeping throughout the grand object in view, which is to arrange that, so far as pos-

sible, the attention may be concentrated on one thing at a time. When a hundred words have been acquired, all the use possible should be made of them as the vehicle for conveying instruction in other respects before the attention is encumbered by new words, in order that when new words *are* taken in hand the student may have his attention in a great measure released from the pressure of the elementary points of grammar, peculiar style of expression, &c.

It is also most essential that these sentences should consist of only two or three words, never more than the latter. It is astonishing how very little new matter overloads the attention of a beginner, and the utmost care is necessary that no more should ever be placed before him at a time than that he can receive a distinct impression of it. A sentence of four or five words is quite too much at first, and nothing is gained by attempting more than the student is equal to. Comparatively speaking, a very considerable time must be given to the first set of sentences, for there is a great deal to be learnt by them.

It is evident that they involve almost all the pronunciation, the inflexions of the nouns and verbs, the mode of combining the different parts of speech, the exercise of the organs of speech and that of the ear on the sound of the language, &c.

The first progress of a student in a new language, at least in one entirely dissimilar to his native tongue, is indeed astonishingly slow, and it is of no use attempting to push him on faster than he can go. We constantly meet with what are called, easy books for beginners, but probably there is not one published in any language that is a hundredth part easy enough or that does not seem to suppose a progress at first a hundred times more rapid than any student makes.

The sentences must of course be translated into English, but it is essential that they should not be written originally in English and then translated into the foreign language.

We do not want to teach a man to speak English sentences in foreign words, but to use the foreign expressions.

The second set of words consisting of 150 may perhaps contain ten sentences for each word, or 1,500 in all.

These may be a little longer than the first, as the student will be able to obtain a clear impression of a greater number of words together, but probably they should not exceed five. After this, the sets of sentences may consist of fewer upon each word, and perhaps only one upon each of the last two batches, and they may be lengthened gradually, the last being of any length.

The essential points of these sentences are therefore,

First, that they should be bonâ fide expressions commonly used in the language, and consequently that they should be originally written in the language by a Native. 2nd, That they should be simple, ordinary, colloquial expressions, and therefore that they should not be written by learned men who would probably spoil them. 3rd, That they should be extremely short, the first set not exceeding three words, and the others very gradually lengthened. 4th, That there should be a large number of them in the first set of words, so as to make as much use as possible of those words before proceeding to new ones. 5th, That there should be as great a variety of expressions in the sentences as possible.

In printing the sentences there should be, first, the Native words separately and in the proper character : 2nd, Under each of them the same word in the English character : 3rd, The most exact English meaning of each individual word ; and 4th, The full power of the sentence freely given in English.

The use of the Native character is, to enable a Native to teach from the book, who does not know English.

As one great point in preparing these materials is, to provide for a person having to learn the language, with the help of Natives who do not understand English, or who are not thoroughly qualified teachers, it is desirable if possible that these sentences should have numerous notes subjoined, giving all the information that can be suggested by each sentence and that can in any way help to give the student an intelligent knowledge of the language. These notes should, if possible, be written by an intelligent Englishman, who will know from his own experience what misapprehensions beginners are liable to form on account of their English

ideas, and what points are likely to be difficulties to them. If the first two sets of words had ten sentences in each, and the last thousand words four on each, the whole of the sentences, on, suppose, 2,000 words would amount to about 10,000 which would be sufficient to make the student thoroughly at home in expressing himself freely on all common subjects. Besides these general words and sentences, each student, according to his profession, ought to have a separate set of words and expressions belonging to his peculiar occupations, whether those of a Magistrate, a Merchant, a Missionary, an Engineer, &c.

But it would be of no use his acquiring this information till he was in some good measure grounded in the more general use of the language, and therefore he should not perhaps take such a list of words in hand till he had gone through the first two thousand general words with their sentences. The professional sentences should contain, of course, only those words already learnt in addition to the technical words. With these sets of words and sentences there should be a short grammar, containing only the first rudiments, in the simplest possible form, so that it can be referred to without loss of time on any point. This however in fact should be made comparatively very little use of. Rules of grammar are not wanted, a man in conversation cannot possibly stop to form the participle of a verb from the root, by considering the rules. If it does not come of itself into his mouth nothing can make amends for that defect. What is wanted is, such a knowledge of grammar as a child of four years old possesses ; that is, a knowledge which enables him to speak correctly, intelligibly, and without hesitation, though he does not know a single rule for anything he says. His speaking *must* be independent of any rules, whether he has learnt any or not. Yet a short grammar, to be looked into occasionally, at first may be of some little assistance in acquiring the inflexions of the nouns and verbs, &c. But the grand means of acquiring a grammatical use of the language must be simply the repetition multiplied, of a good variety of correct forms of expression.

Nothing can be more absurd than insisting upon knowing the rules of grammar before a student can be allowed to know a language.

If a man talks English grammatically, that is, correctly, he is never examined as to whether he knows any rules; perhaps he never learnt a line of any English grammar, but it makes no difference. But it is always expected that a man studying a foreign language should be able to stand an examination of a kind neither he nor his examiner could stand in his mother tongue. The same man who meets a stranger in the street and knows well by the first sentence that he utters whether he is perfectly acquainted with English or not, is perhaps on his way to some place where he will pass hours in ascertaining whether a student has a good knowledge of a language foreign to him.

These are therefore the materials which I would put into any man's hands, who wants to study a foreign language for colloquial purposes: viz., a vocabulary of perhaps 2,000 words, divided into sets of, from 100 to 250, with about ten thousand common forms of expression, composed only of each set of words and those words previously learnt. These printed both in the Native and English character, with a verbal and a free translation, the sentences to be aided if possible by copious notes giving all the collateral information possible; and to these to be added a very short rudimental grammar.

It will not perhaps be necessary to give the verbal translations of any but the first 2 or 3000 sentences.

As to the student's further study, he may of course now with perfect ease follow the ordinary plan; that is, take up any book that contains the sort of words and matter most suited to his line of life, with an ordinary dictionary and grammar to which however he will have very seldom to refer. He will know so large a proportion of the words that the context will generally show the meaning of any new word he meets with, and he will lose very little of his time in that which usually occupies about three-fourths of all the time expended in such studies, viz., in turning over the leaves of a large dictionary and guessing which of the several meanings there found for a word is compatible with those of the other words of the sentence before him, many of which he has also yet to ascer-

tain. But his great business should of course be to converse as constantly as possible in order further to exercise his tongue and his ear, and to add to his stock of forms of expression. It is to be remembered that, in using books, a principal exercise should be, reading aloud and having them read aloud to him by a Native.

If his occupation will require formal writing or translating, of course he must exercise himself a good deal with books. It is well known that the most easy and certain way of acquiring a correct and easy style in writing in any foreign language is to make or procure accurate translations of Native books, and then re-translate them, comparing such re-translation with the original and thoroughly considering the difference between them. This can be done with the greatest ease and economy of time when such a good fundamental knowledge has been acquired as is supposed to be obtained through the system now proposed.

The next point to be considered is the mode of using these materials.

The student begins with the English letters representing the sounds. The teacher sounds each letter and the student repeats it immediately after. This is done many times with those letters which represent sounds entirely strange to the learner. The most essential thing is to learn where to place the tongue in these last sounds, without doing which it is impossible he should utter them correctly; and this must be most patiently and diligently practised, because this new motion of the tongue must be acquired to the same degree of facility as he has in pronouncing the sounds of his own language. This cannot possibly be effected except by long continued use of the organs of speech. At first, each of these letters should be pronounced perhaps ten times over by the teacher, and repeated by the student instantly, the latter always observing carefully the difference between his own pronunciation and that of the teacher's, which immediately follows.

The grand means to attain to a correct pronunciation must always be thus for the learner to attempt it both immediately after, and immediately before, hearing it correctly pronounced by a Native. Just as in learning to write it is not sufficient first to look

at the original and then try to imitate it, but after writing it to look again at the original to see in what respect the copy has failed. Of course it will only be necessary to do this with the new sounds, which will generally be only very few.

The student next takes the first list of 100 words, which are all written in the shortest form, that is, the radical form of the verb, &c., as we should write in English, *good*, *go*, *little*, *come*, *&c.* The teacher should then pronounce the first word deliberately and distinctly, and the student should repeat it, followed by the English meaning of it, when it should again be repeated by the teacher, and this suppose five times at first.

In this way the whole hundred words would be gone over many hundred times before the student ventures to attempt pronouncing them by himself. The teacher and student should sit at some distance apart, so that it may be necessary to speak pretty loud. In these first exercises the student should have the printed words before him, that he may have the assistance of sight in addition to that of hearing in impressing them on his memory. It will of course be at first tiresome to continue this exercise long, nevertheless the longer the better, and if a person could arrange to do it for one or two hours, at three or four different times in the day it would probably be best—but he should not attempt to learn them by heart because his pronunciation will not be sufficiently confirmed.

When he has become tolerably familiar with the words of the first set of sentences, both as to pronunciation and meaning, by thus repeating them with his teacher several times and with his book before him, he should put down his book and go over them again in the same way several times, without seeing the words, so as to be wholly dependent upon the ear. From the first, the ear must be exercised as far as possible without any aid from the eye. It must be kept continually in mind that the sight is to be used as little as possible for the reasons before given. The sentence should not be read together the first time of going over because the student is not yet able to receive any distinct impression from more than one word at a time. The student should not yet trouble him-

self about the mode of framing the inflexions that he meets with, but be content to take the word with its exact English meaning as he finds it. In this way he should go through the first 1,000 sentences with his teacher which will perhaps take him 15 hours, or suppose three days' study, during which time he would have repeated every one of the first hundred words on an average about a hundred and fifty times, including the separate readings of the list of words.

Less than three times repetition of each word is not sufficient to ensure the students correcting himself when he pronounces it imperfectly the first time.

After the first and second reading of the sentences, repeating each word by word, the whole sentence should be repeated in the same way at least three times over, the student repeating the free English translation after the foreign sentence.

The readings should be repeated till every word has been heard and uttered suppose 600 times. During these readings the grammar of the nouns and verbs may be looked into a little ; and, lastly, the sentence should be learnt by heart. And when the student is well exercised in the pronunciation by these means, so that he can trust himself to utter it without first hearing it spoken, the sentence should be again gone over in the same way, but the teacher beginning by repeating first the English word, when the student gives the foreign one, the teacher immediately repeating it again and so on. But if it is found that the student cannot yet remember the word and pronounce it with perfect ease, they should be read over again in the former way. When able to do it, the whole set of sentences should be again gone through without the words being repeated individually, the teacher the first time giving the foreign sentence, and the next time giving first the English sentence.

It may be supposed that all this will not be necessary ; and it certainly is not, in order to obtain such a knowledge as is usually supposed to be sufficient, that is, a knowledge which, when brought to the trial of conversation, is found to be of little or no use. But it will be found that, to obtain a really familiar acquaintance with this first set of words and their easy and correct pronunciation and use, these multiplied repetitions are absolutely necessary.

Nothing but a long continued exercise of the ear and the organs of speech upon a great variety of actual expressions can give either that quickness at hearing and pronouncing, or that facility of correctly combining the words, which are essential to their effective colloquial use.

It must be particularly observed that this first set of sentences thus acquired implies much more than might appear from the first glance, namely, there is involved in it as it were the whole pronunciation of the language; for a man who can pronounce freely and correctly 100 words will have little difficulty in pronouncing all the rest: 2nd, a knowledge of all the inflexions of the nouns and verbs: 3rd, the mode of combining and arranging the different parts of speech.

Thus, though only 100 words are used, some real and considerable progress has already been made in the knowledge of the language.

This first set of sentences should not be laid aside till they are so perfectly familiar, that almost any one of them can be repeated with the utmost readiness, on the English translation being uttered. Nothing whatever will be gained by meddling with new materials till these first are thoroughly wrought into the student, and made as much part of himself as the words and expressions of his own language.

The second set of words and sentences must be read over and thoroughly appropriated in the same way as the first.

Probably these first 250 words with their sentences may be mastered in a month of steady study of 3 or 4 hours a day, and 750 additional words with about 3,000 longer sentences in another month, completing the first 1,000 words in two months. After the thorough grounding which this will give in every respect, in pronunciation, in expression, in hearing, in grammar, &c., the additions will be made with much greater rapidity.

Every thing depends upon this first grounding being through and complete. Nothing but such repetitions will accomplish this object—there is no other way of doing it.

A soldier may be shown how to march, and he may be made to move his legs in the manner shown in a few steps, but nothing but long continued practice can possibly enable him to do it both correctly and with ease; and it is the same with the muscles of the tongue, the ear, and the brain, as it is with the limbs.

A girl may have the finest ear possible, but that will not enable her fingers to run over the notes of a piano or her throat to produce the notes of a song freely and correctly, without long exercise of those organs.

After the first month the teacher will be required much less, because the student can be trusted to pronounce when he is alone, provided he exercises with the teacher for some time daily. He should always read aloud by himself just as when he reads with the teacher, both because, the great point is the exercise of the organs of speech, and hearing, and also because the pronouncing of the word is so great a help to remember the meaning. It must however be remembered that in this solitary study as little use as possible should still be made of the eye. The word or sentence should be merely glanced at when necessary and the repetition should then be made without looking at the book.

With respect to the time required, I cannot speak certainly, because I have never had an opportunity of seeing the study commenced with such materials properly prepared beforehand; but so far as I have seen it tried with imperfect materials, the result was certainly excellent.

In the only case where an approach was made to a fair trial, a gentleman studied irregularly, but equal to about two months' continuous study of five hours a day, and from that time he went out and performed all his duties without an interpreter, having constantly to converse with the middling and lower classes, most of whom had never spoken to a European before.

This was a real, practical and effective acquaintance with the language, though within small limits as to his number of words and expressions at first starting; but then his ear and tongue having been well exercised, he could both make himself under-

stood and he could recognize the words spoken to him, and consequently he was in a position to make steady progress in the correct use of the language from his intercourse with the people, and this he accordingly did. It would of course have been much better if he could have continued the same course of study, though it were only for an hour or two a day, by which he would have far more rapidly added to his stock of words and expressions.*

It is very probable that many persons would complete the appropriation of the first 1,000 words and their sentences in one month.

I would now only ask which is preferable as a foundation, such a really effective use of a language, though within small limits; or such a loose, vague, and useless knowledge of a vast number of words, with the rules of grammar, as is usually acquired after at least many months of hard study, during the whole of which time too, the attention has been kept in a very injurious state of tension by the overwhelming load of new things that has continually been laid upon it at one and the same time. I believe that in general little effective colloquial use of such a language is acquired within a year of hard study, and that often two or three years or more pass before the student can talk it tolerably, though only a portion of that time of course is actually employed in study. On one occasion, I was acquainted with two men who studied intensely (about ten hours a day) for nine months, after which upon trial they found that they could scarcely hold the slightest communication with Natives.

A remarkably apposite passage from the life of Dr. Hope may here be quoted which I have just met with, and in which a part of the very means here proposed are stated to have been used by him with the most remarkable success, though he did not begin upon this plan, but merely learnt the colloquial use of a language after

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* An educated Native, who had, I believe, helped to teach this gentleman, lately told me that he had overheard Natives speaking of him, who said that if they had not seen him, they should not have known that it was not a Native who was speaking Teloogoo.

he had acquired a considerable stock of words. He had already picked up a good knowledge of French and Italian, so far as mere reading went, and he imagined like many others that a little practice on the road would enable him to speak the language sufficiently to carry him through his tour ; but it was a very different thing to hear the lessons of professors and to converse with the Natives of the country. Of this he found a very humiliating proof. He went to engage apartments at a private hotel, but after a pantomimic performance of twenty minutes between himself and the landlady, it was found that neither could in the slightest degree understand the other, and after laughter and reciprocal bows he returned in despair. Having settled at another hotel, he now determined to devote twelve hours a day to the mere practice of speaking French. His first step was to engage a French Master for twelve lessons, and to make him go through the drudgery of reading three words at a time, while he mimicked them as closely as he could. This was singularly disagreeable to the master, but it was all that Dr. Hope wanted and he was inflexible. He thus secured himself against any gross error in pronunciation. He happened to possess a Wanostrocht's grammar with a key to it, a grammar which is remarkable for the *great number* of *simple exercises* which illustrate each rule. He now translated these exercises from English to French, correcting himself by constant reference to the Key. In this way he went two or three times through the grammar in the course of a month *gaining flexibility of tongue* and losing the fear of hearing his own voice. He at the same time adopted another device ; he went to dine daily at a small and crowded restaurant frequented by the Garde du corps, where the company was so closely packed that he could not help hearing the conversation of two or three contiguous talkers. In this way his ear got *familiarized with all the sounds of the French language*, whether quick or slow, correct or provincial. At the end of a month he ventured to sally forth, and, having a fancy for the rooms of the private hotel to which he had originally gone, he waited on the landlady. On entering he addressed her in fluent French, explained his wishes, &c., the landlady the meanwhile, with up-raised hands and a look of utter amazement, exclaiming, " Voilà un miracle ! you cannot

be the same gentleman that called here a month ago and could not speak a word of French."

This case has no reference to the principles here proposed, so far as the use of a restricted vocabulary is concerned, but it shows how perfectly ineffectual the knowledge of book language and the exercise of the eye was, for colloquial purposes, and how complete the success was both in respect of time and effect, when the means here proposed were used, viz., the thorough appropriation of a good stock of simple familiar sentences, and the diligent exercise of the ear and tongue.

He was totally without the colloquial use of the language, so that he could neither understand a word spoken nor speak one intelligibly when he began to adopt the means he did, and in one month he found himself perfectly at liberty in conversation.

In the same memoir it is afterwards related;—"Having had a lesson in France on the inconvenience of not being able to speak the language of a country in which one is travelling and studying, Dr. Hope guarded against a similar inconvenience in Italy. Before leaving Paris he improved his pronunciation of Italian by taking twelve lessons, as he had formerly done in French, and he provided himself with a brief practical Italian Grammar, with Exercises referring to the rules, and a key to them.

" During a tour in Switzerland it was agreed that he should walk in advance of his friend for an hour daily, to give him an opportunity of *practising these exercises viva voce.* This plan answered perfectly; at the end of the time he spoke Italian fluently."

It may perhaps help to show yet more distinctly how far the principles here advocated differ from or agree with some of the commonly received notions on the subject, if I place my views side by side with those lately advanced in an elementary book for helping the student of an Indian language.

The 1st principle laid down is, " Do not proceed too quickly. An entirely new language requires great accuracy in the mastering of its elements." In this I agree, but I consider the book itself implies a progress in the learner immeasurably beyond the reality.

2nd, " Write down every thing from the beginning. Read always with pen or pencil in hand." This is directly opposed to two of my principles, one an essential one, the other, one of great importance. The first, that every thing is to be learnt through the ear, and not through the eye, because it is the ear that is to be employed in using the language and not the eye. The other, that the foreign character should not be used by the beginner, because time must be saved in learning one thing at a time, and the character is not necessary to enable one to learn the language itself.

3rd, " Read aloud all the exercises with a Tamil teacher, and be very careful in ascertaining the correctness of what you have written." Here it is evident that there was some sort of loose notion about the exercise of the *tongue*, but it also shows that there was nothing like a real apprehension of the essential importance of this, nor of the extent to which that exercise should be carried. Nor is any thing at all said about that which I insist upon, as the main point, viz., the impossibility of learning to pronounce correctly, and the certainty of being established in a false pronunciation, unless for some considerable time, no word is pronounced without referring at the time to a correct standard, without the student hearing one word at a time pronounced both immediately before and immediately after himself by a Native. As to the latter clause of this hint, I urge that the only possible way to secure the correctness of what one learns is not to attempt to invent anything, but to be content to learn every thing, every sound, every word, every expression from a Native.

4th, " At first, whenever you meet with a new word look for it in the vocabulary, and decline and conjugate it in full. My rule is, never meet with a new word, and never lose a minute in looking for a word in a vocabulary, or in *guessing* which of the different meanings that may be there given is the right one ; and never lose time in declining and conjugating a word in full. Use only limited lists of words, and thoroughly appropriate every one by hearing it applied in a great variety of short sentences, in the course of which exercises, the grammar will necessarily be picked up long before the pronunciation and value and use of the word

are fully acquired. Yet it will be of some use to look occasionally into a short grammar containing the inflexions of words.

5th, "Begin to talk, though with stammering lips, as soon as possible, the very first day. Never speak English to a Native if you can help it. Why say *salt*, when you know the word, *Uppu?* Do not be afraid of making mistakes."

This rule contains the very essence of the ordinary system, or rather of the old notions. It is diametrically opposed to the universally acknowledged and universally applicable principle. "Whatever is habitual is easy." It is always easier to do a thing the second time than the first. My principle is, Be afraid of one thing, making mistakes. Every time that a mistake is made, one step more is taken towards a confirmed habit of making that mistake. Why do men in talking English as their own language go on putting *h's* in the wrong places and leaving them out all their lives, in spite of their getting into a different class of society, where they continually hear the correct pronunciation in this respect, without ever being corrected? Because by habit their perceptions have been so blunted that they never perceive that they make a mistake. Do we not keep this principle of avoiding mistakes in view in almost all other cases excepting this? Do we set a child to make a rude imitation of some letter and then leave him to repeat it without a standard? or, do we insist upon his incessantly looking at a standard, and never making one written letter without trying to imitate that standard which is placed before his eyes?

My principle therefore is, never, attempt to guess at any thing, whether it is a sound, or word, or an expression. Take the most effective steps you can to prevent your ever "making a mistake." Is there not enough work to do to learn the real language, that you must take measures to oblige yourself to add to it the unlearning of your own mistakes? Every time you pronounce a word wrong you have that to unlearn, On no account therefore attempt to *speak* in the proper sense of that word till you are established in

1st. A sound pronunciation.

2nd. In the knowledge of the true value of a stock of words.

3rd. In that of a good amount of Grammar.

4th. In that of a large stock of bonâ fide Native expressions.

Is not this principle undeniable? Does a drawing master tell his pupil, Go and make rude and absurd drawings of a hand or a foot, and then occupy yourself in unlearning the habit you have been acquiring, or does he set before his pupil a true representative of a thing, and say, Imitate this, with the most earnest and close attention and never make a line without referring to the standard? Which pupil would make the greatest progress and which would be most likely to attain to perfection in his study,— one who was always trying to make rude drawings of a foot out of his own imagination and then laboring to correct them, or one who did not attempt to invent at all, but kept exercising himself in imitating a correct representation of a foot.

6th "Be very careful in noting down differences in idiom between your own language and Tamil. If you hear much Christian or Cutcherry Tamil, beware of thinking all you hear to be really Tamil. Try to cultivate a Tamil ear, so as to detect an unidiomatic expression as you would a false note in music. You should *understand* all you hear; you need not *use* any expression that is not good Tamil."

I would only ask how a student can possibly learn to distinguish between true language and false, except by learning the true, and taking care as far as possible not to come in contact with false language, whether coming from himself or any body else, till he has acquired a sound taste and judgment, by a *confirmed* knowledge of the true language.

The simple rule is, *Learn* the true language, and then you will not waste your time in acquiring and trying to unlearn a false one. Sow clean wheat in your ground, and not wheat and weeds mixed together, and then you will not require to employ all the season in trying in vain to root out the weeds which you have yourself sown.

It is this sort of instructions, continually inserted in books of instruction in languages, and which are directly opposed to well

known general principles, which show so plainly how entirely undigested the subject still is, and how people in general are still acting upon notions that they have never examined, and which will not bear the least examination.

In the book which is prefaced by these rules, the materials provided to assist the learner of Tamil are all prepared upon the usual false principles :—

1st. An unlimited vocabulary is used, so that every word must be learnt and forgotten a hundred times over.

2nd. All sorts of words are introduced, words perfectly useless to a beginner, words derived from Sanscrit and scarcely ever used in conversation, words used only in books translated from English by Englishmen, &c.

3rd. The sentences are certainly not all written by a Native, so that the learner takes up the book with the encouraging feeling that he does not know which are true Tamil sentences and which are not.

4th. Almost all the sentences are much too long for a beginner.

5th. Many of the sentences are such as it is quite useless for a beginner to learn.

6th. English sentences are given without the corresponding Tamil. How is the *learner* to discover what the proper Tamil would be unless he is told ?

7th. The same with the Tamil sentences. What can be the use of leaving the *learner* to guess what the English meaning is, knowing that when he has guessed it, it may be either right or wrong. Suppose a Tamil man were learning English, how could he find out the expression we use when we ask who a certain person is ? How could he ever guess the expression, *Who's that ?* Or could he find out of himself these expressions, *What's the matter ? Where has he been ? Come away. I'd rather not. Never mind Whether or not. I can't help it.* You might as well set a man to guess, at the words of a language as at its common expressions.

When I put this book into a Moonshee's hand, the first thing he said, was, Many of these sentences are not common Tamil expressions, and many of the words are not commonly used in conversation.

This might be said of almost any book, I suppose every book, of the kind. What is a learner to do who has no better materials? It is destructive for a learner to use a book, when he is not sure whether the sentences are Tamil or not.

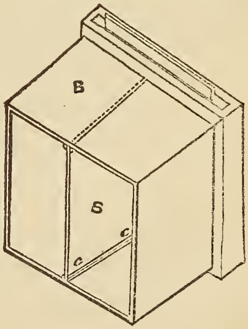
I mention these particulars of this book, as illustrative of the mistakes, and undigested ideas that are current on the subject.

X. *A mode of taking Stereoscopic Portraits with a common Camera. By Lieut.* L. PAXTON.

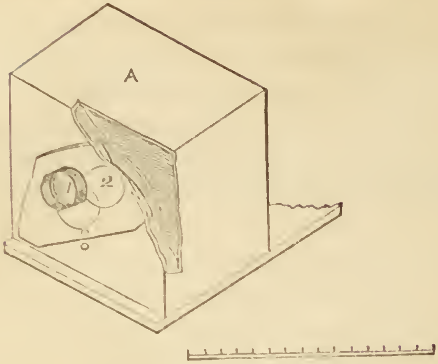
(Communicated to the Madras Photographic Society and by them to the Journal for publication).

Thinking it may be useful to Photographers who wish to take Portraits for the Stereoscope, but who have only a common Camera I send the plan of an addition by which this may be done.

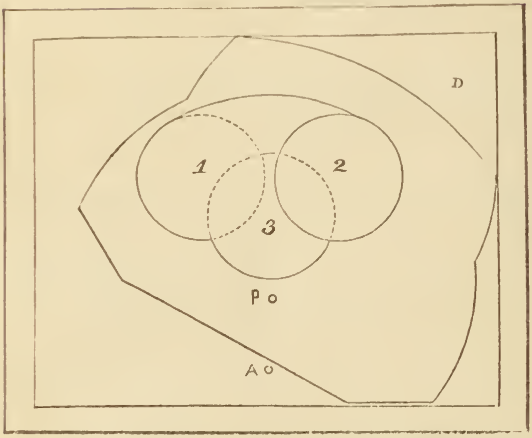
As very nice work is not required, it may be made by an ordinary carpenter and at a very slight expense. The time taken to do both pictures is but little above that required for the two exposures. The back of the Camera B. remains unaltered with the exception of thin strips of wood *c. c.* which are attached to it to receive a thin screen S. which separates the pictures; the length of the screen depends on the focus of the Lenses. There should be as little interval between it and the exposing frame at one end, and the back line of the combination on the other as possible.



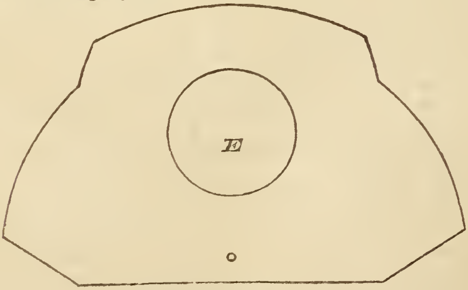
The front of the Camera required may be made of teak wood in



Scale of Inches.



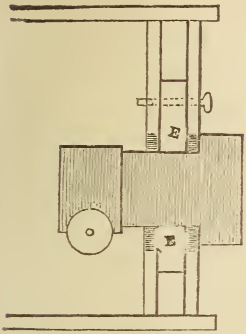
All parts of slider and front of Camera should be carefully blacked, the slider should move freely between the partitions, which should not however be too far spent so as to admit light.
P position of Pivot for Stereoscope pictures.
A do. for single pictures.



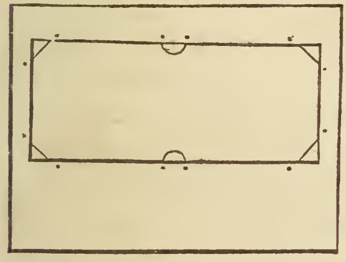
Slider half size.

the form represented in Figs. A. and D. the Lenses being merely fitted into the shifter E. as in the accompanying figure so as to render it unnecessary to injure the Original Camera by removing the screw ring.

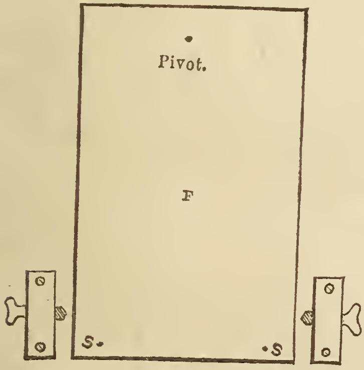
In taking a picture, the lens being at 1 Fig. A, the exposure for the first picture is made in that position, the lens is then closed and shifted to 2, the exposure made and the pictures are completed. After printing however, the pictures are in their wrong position and require to be



changed the right one becoming the left and *vice versâ.* Whilst for glass positives it is necessary to use separate glasses, the frame having a smaller central support as below. As the centre of the lenses in taking Stereoscopic pictures is a little above the centre of the Camera, the position of the glass plate must be made to correspond.



I do not observe that the glasses being parallel instead of converging towards the object makes any perceptible difference in the pictures, but when a table is used to support the Camera, such convergence might be easily given by having a pivot under the front of the Camera and limiting its lateral motion by screws placed as in the accompanying figure F.



SS two snipe shot which allow it to move easily.

I have found it impossible to get made here the rather complicated exposing frame usually described in books on taking Stereoscope pictures, when a system of parallel bars is used on a table to shift the Camera and at the same time to move the collodionized plate. With a Camera constructed as above the parallel frame might be used with advantage for groups of figures and distant objects, moving the object glass in a direction contrary to that given to the Camera, when the pictures would be in their correct places on the glass. I send enclosed a picture or two which will show that

the system answers,* though they are not very good specimens of Photography. Two of them are specimens of Hindoo carving in stone, the camera having been constructed a good deal with the idea of copying the curiosities in the many temples in this part of the country.

XI. *Report on a reputed* † *Coal Formation at Kota on the on the (Upper) Godavery River. By* PHILIP W. WALL, *Mineral Viewer at Madras.*

I have visited and examined the district around the village of Kota near the junction of the Pranheeta and Godavery rivers upon which reports have been made to Government of the probability of Coal being found beneath the surface there.

Although, in the report made by Dr. Walker in the year 1848 I could discover no positive evidence of the probability of the existence of a Coal formation in this district, I considered it desirable to provide myself with some means of making more than a mere superficial examination, of this particular locality, on account of the confidence with which opinions had been expressed, upon the subject, and that both Drs. Walker and Bell, whose examinations of the country must have been very extensive and minute, were led to expect satisfactory results from a search beneath the surface at this place.

Having seen in the Arsenal Stores at Madras, some light sets of Boring tools, (used for the trial of the ground for foundations of Public Works,) I applied for and obtained the use of two sets of

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* We have examined these pictures and find them to be Stereoscopic.—A. J. S. SEC. PHOT. SOC.

† Vide Dr. Walker's report on boring for Coal at Kota, *page* 261, *Vol. I. No. II. N. S. of this Journal.*

these;—in order to adapt them to my purpose it was necessary to make some few additions to them;—these I readily got constructed at the Government Workshop at Dowlaishweram, and also obtained from the officer in charge of that establishment, mechanics with other tools I considered it desirable should accompany me.

A detachment of seven Privates and one European Corporal of the Corps of Sappers and Miners who had been practising the use of the Boring tools in Dowlaishweram, were also by the kindness of the Commandant of Sappers placed at my disposal.

Thus equipped, my purpose was to reach Kota as expeditiously as possible, set my staff to commence boring at that place and proceed myself to examine the surrounding country.

By this means I hoped to get my boring party into working order at Kota and provided with such appliances, as I required from the district; and, in the event of my subsequent examination determining any particular spot where boring would be more desirable, I proposed removing my Plant and Staff from Kota to this place.

In the examination of the country I had proposed, I perceived much information was open to me in my march to Kota, if it could be undertaken along the course of the river. I obtained therefore the use of one of the Upper Godavery Paddle boats worked by six coolies; this I found of great service, it accompanied me to within a few miles of Aheree in the Nagpore country.

I left Dowlaishweram with my staff and materials on the 7th February, the Government Steamer *Pottinger* conveying us part of the distance to Buddrachellum, and arrived at Kota on the 13th of March, my camp with the tools, &c. arriving on the following day.

The great length of time occupied in thus performing a march of 240 miles was mainly owing to the difficulty with which I procured carriage for the materials. Government had provided me with one Elephant, and on further application had given orders for two more to join me, but unfortunately I only became aware of the difficulties of this nature in my way and made my application for these animals, a short time before my departure, they reached me therefore in time to be of service only on my return march.

After leaving the Government Steamer, I sent my camp to march by land, and proceeded myself in a Paddle boat, taking only the road through the jungle occasionally.

My staff could have reached Kota in somewhat less time than they did, if it had not been impeded by the slow progress of the materials ;—I had found it requisite to give instructions that the whole party should keep together as much as possible.

As for myself, I found it requisite to make my observations along the course of my march somewhat in detail and to visit every spot on either side of the river where the possibility of an opportunity of examining any exposed section of the rocks of the country might be presented, my own daily rate of progress could not therefore have been expedited.

The result of the observations in my journey was, that I had passed over a considerable extent both superficially and in thickness of a sedimentary deposit of sandstone and limestone, and at its edge or junction with some one or more great volcanic disturbances or faults, these had in fact formed the valley of the river, the channel forming a tolerably general line of division between the metamorphic range of hills on the eastern and sandstones &c. on the western side, occasional arms or branches of this metamorphic range, stretching across the line of the river and forming the great obstructions or barriers in its bed at Buddrachellum, Enchampilly and Aheree.

In the course of my examination of these sedimentary beds in my march up the river, I found nothing in the remotest degree approaching to those indications which are met with in European Coal districts, neither in my examination of the pebbles in the river bed did I discover any thing of this nature.

I could of course form no conclusion at all or be surprised at this negative evidence, as I was quite prepared to meet with a totally different state of circumstances connected with Coal districts in India to those of Europe, and that therefore an actual examination of the rocks in any district in detail through their entire thickness was necessary, in order to pronounce decidedly

that the probabilities were against Coal being found in them or otherwise.

On my arrival at Kota, I found I was still in the same series of sedimentary rocks I had been passing over in my journey along the river, and was fortunately soon able to identify the limestone at Kota under which the Coal was presumed to exist, with the limestones I had observed at other places on the river, one of which was at a point 80 miles lower down.

This limestone although seen cropping out at several places on the river—at Yeytoor, a village, 2 miles below Chintagorem, at a point on the left bank opposite Pallemella, (Warrugoora,) and subsequently as I discovered at a place a little north of Kumalapetta, I had not been able to observe beyond a very small extent in thickness, I therefore proceeded on arriving at Kota to carry out my original intention to start my people to bore, and immediately selected a site upon this limestone which offered the best facility for carrying on the work.

A Sketch Map* showing the nature of the rocks and their inclination as indicated by an arrow pointed in the direction in which they dip is herewith appended, the dark blue line shows the outcropping of the limestone.

At Dowlaishwerum there are sedimentary deposits, consisting of a series of thin layers of very bright colored clays, above this a very irregularly stratified sandstone, of various degrees of hardness, a very small extent of this sandstone now remains in this district in isolated hills, it having been removed by the denuding action of water from the intervening valleys, its thickness does not seem to be very great about 50 to 60 feet, this and the underlying clays appear to be the result of the decay and washing of the volcanic hills lying to the north.

This character of formation extends to Rajahmundry.

Proceeding thence along the course of the Godavery, the banks consist of alluvial deposits until we reach Polaveram, we now enter

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* Vide Plate I.

a volcanic country, syenite and other forms of granite with metamorphic rocks are only to be seen for a considerable distance. The river here passes through a narrow valley termed the Gorge, formed by an apparent fissure in the range of altered and volcanic rocks. This character of country continues till we reach Parnasala about 20 miles above Buddrachellum, with the exception of one spot, Riagoodum (right bank) 6 miles south of Buddrachellum, where the first appearance of a sedimentary deposit occurs. It consists of beds of sandstone very various in texture, deeply tinged with iron, and having veins of a harder sandstone, containing a larger percentage of iron traversing this mass in various directions. It is very uneven in its bed and much disturbed, the average dip is to N. W., in amount 20.°

Between Parnasala and Lingala we again have sedimentary beds, consisting of very coarse conglomorates and breccias, the latter containing angular fragments of limestone.

The course of the river is now for some distance entirely through a country formed of stratified rocks, the out-croppings of which are at frequent intervals to be seen projecting into the stream and on its banks.

These sedimentary beds extend into the country on the right bank only, on the left bank a range of hills composed of metamorphic rocks extend along the course of the stream. These consist of sandstones that have undergone various amounts of alteration in some places rendered only partially crystalline by the action of the volcanic heat, whilst in others their original character is entirely lost, generally they do not show any violent disturbance except at particular places, these are at Buddrachellum, Enchampilly and Aheree, and form the points of obstruction in the navigation of the stream. The stratified rocks seen on the right bank consist of series of sandstones in general character, resembling that already described as occurring at Riagoodum. They are occasionally much disturbed and contorted, in one place opposite Nargarum, they are standing vertical, the surface of beds being scored and polished by the attrition of the beds upon one another;—where however a general inclination of the beds is to be ascertained, it is to the W.

occasionally a little to the S. of W. and sometimes to the N. of W., the direction of the river being N. W., at this part we are traversing in our course up the channel from the lower to the higher of the stratified rocks.

We continue in this upward direction in the series until we reach Yeytoor, where occur the uppermost beds I was able to examine. These consist of very uniformly stratified limestones 6 inches to 18 inches thick, the layers parted by soft clays and fibrous limestone, of these there were only visible above the water in the river 12 or 15 feet in thickness, above these occur beds of deep red marls, and variegated clays, their inclination is very small being about 5° only, and to the W. S. W.

From Yeytoor to Taicologodeen the course of the river leads us downwards, in the series again we pass over red and pink clays, and lastly to a white sandstone, at the latter place. Immediately after Taicologodeen we came into the metamorphic rocks forming the Enchampilly barrier.

After passing over about 12 miles of these, there occur near the village of Punkenna beds of limestone, very similar in external appearance to those seen at Yeytoor, they are in thickness from 12 to 18 inches and parted by thin seams of clay and fibrous limestone, their dip is to the N. E. about 5° to 10°,—at low states of the water in the river, they are seen on both banks, a considerable extent in superficial area being on the left, but owing to their low inclination a small amount only in thickness can be observed.

From this point to Nuggrum, we have frequent opportunities to observe the beds on both banks of the river, the general dip of them is N. E., the course of the river being N. W. we traverse along the strike of these beds somewhat however to the deep; we reach the lowermost beds on the right bank opposite Nuggrum; they consist almost entirely, of ferruginous sandstone, of various degree of coarseness and traversed by numerous veins of a harder description of the same material.

Between Punkenna and a point in the river opposite Mahadeopore, we get at very low states of the water in the river a small

extent of mottled clays, these again outcropping at Sironcha where we have left the main stream of the Godavery for its tributary the Pranheeta, these are the immediate underlyers of the limestone beds at Punkenna as inferred from their relative position and their dip, and subsequently confirmed by the boring to be the case.

At Sironcha the Fort stands upon a hill, the side of which towards the river presents a steeply scarped face, and good section of these clays, they are here very hard, very various in colour from a deep red to a fine pink and grey, they dip to the N. E. or N. N. E. about 20°, they consist of layers of 3 to 6 feet in thickness, the lowermost layers being interstratified with the uppermost beds of the sandstone series beneath.

At Nuggrum, a well exposed section of this sandstone shows that the alternation with these clays has ceased, as also on the opposite bank of the river we have still lower beds of sandstone without clays.

Proceeding again up the river, the Sironcha clays are seen to continue for some little distance on the left bank, exposing beds above those at Sironcha, they assume a much deeper red colour here, on the right bank we have the sandstone occasionally appearing.

The limestone at Kota is the next rock to be seen, it has a N. E. dip of about 5°, the general inclination of the beds from the Enchampilly barrier to this point.

The banks of the river for some distance are now alluvial soil, until the villages of Annumpully and Sumpatum, here we have a whitish sandstone with a layer of red clay; in the bed of the river immediately above this point I observed lumps of limestone and red clay in appearance closely resembling the beds at Kota, the stone is not any where on the banks exposed in situ, but from the fragments found being large and angular, not worn at all on their edges their position is without a doubt at this place and outcrop only concealed by the water.

This is the last point in my observation along the river of the unaltered sedimentary rocks, those next exposed are metamorphic

in character and continue to Aheree, the extremity of my journey in this direction.

Such was the information afforded in the course of my journey up the river; I had passed, in travelling from the Doomgoodiem to the Enchampully barriers, over a series of conglomerates and sandstones, and subsequently beds of limestone, having a tolerably uniform dip to the S. W. and from Enchampully westward, over what appeared to be the same series in an inverse order commencing with the limestone and having an inclination to the S. E. or in the opposite direction, all of these dipping towards an imaginary line or synclinal axis,—this line passes through a point midway between Yeytoor and Waragooroo, in a direction slightly to the westward of north.

That they were the same series was evident, from the order of superposition of the various beds, and from the fact of the identity of the limestone being clearly made out at two points, viz. at Yeytoor and at Kotà, by the abundance of fish scales of the same character being found, at these two places.

In the town of Mahadeopore, a red sandstone is seen cropping out, with the same hard iron veins traversing it as in the neighbouring river bank, and still further to the S. W. about 3 miles from Mahadeopore, a small range of hills called Guntay Magoota, presents on its western side, a well exposed section of 200 to 300 feet in height. These beds are sandstone throughout in strata of 8 feet and upwards in thickness, the lower beds being very hard and compact: the upper beds as seen at the top of the hill, contain angular fragments of indurated clay, white or reddish in color or composed of thin layers, alternately white and reddish;—sandstone containing these fragments of clay, is to be seen near Nargarum, south of Yeytoor, it no doubt is the same bed, dipping from this place under the limestone to Guntay hills.

The beds at Guntay dip to the N. E. about 15° to 20°, they are much more uniform in the direction of their dip than on the river bank, where their close proximity to the line of the fault running

along the eastern or Nagpore side from Buddrachellum, has caused them to be much disturbed in places, on this account it is very difficult to ascertain their general inclination either in amount or direction, and a large number of observations were requisite before this could even be surmised.

At Kota the beds of limestone dip at a very low angle and a very small amount in thickness of the beds can be observed ;—resting immediately upon them is alluvial soil, forming the river bank at this place : for some distance both up and down the stream, the nearest place where beds lying beneath those at Kota is to be seen is at Annaveram, one mile distant,—here a whitish sandstone crops out having also a N. E. dip ; by comparing the inclination of the strata at Kota and the distance between these two places,—I found the thickness of the intervening beds could not exceed much if at all 200 feet,—having started my boring, therefore, at Kota I determined to continue it there and examine as much as possible of these concealed strata, which I could nowhere,—either up or down the river, examine sufficiently in detail at the surface.

The boring was commenced on the 19th of March,—on the 6th of May, it had reached 111 feet in depth and come upon a bed of red sandstone ; this proved about 5 feet in thickness, and was succeeded by blue clay, and sandstone alternately ; we continued the boring until the 14th, when it had reached the depth of 145′ 8″ and was in a white sandstone much resembling that I had seen cropping out at Annaveram and which I concluded to be the same.

The boring was through 30 feet of very hard limestone beds, with partings of thin beds of shaly and fibrous limestone and clays, after which a series of hard calcareous clays and marls, variegated in color, or of decided blue or red, until the sandstone was reached ; no where did I perceive the slightest trace of Coal.

* A section of the ground as shown by this boring is appended.

Through the limestones and succeeding clays, our tools brought up frequently traces of the fish remains mentioned below.

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* Vide Plate II

I was somewhat surprised I did not pass through in boring the bituminous shale alluded to by Dr. Walker in his report, upon examination of the beds in position above those I was boring through however, I found this substance interstratified with thin layers of sandstone about 1 inch thick, and layers of limestone, and at the same time quantities of the fish remains.*

Organic Remains. At Kota in the limestone beds, I found great abundance of fish scales, no doubt similar to those brought from this spot, by Drs. Walker and Bell, they proved of much value to me as identifying the beds at Yeytoor, where I also found them,—with those at Kota.

At Yeytoor, I also found impressions, answering the description given of the Crocodilian remains found by Dr. Bell.

At Sumpatum, in the white sandstone, the immediate underlyer of the marls and clays of the limestone series, there occur very large silicified trunks of trees, they are in considerable number and by the action of the water wearing away the enclosing sandstone, they are seen prominently projecting from the surface of the rock.

Near the same place and in this sandstone are a number of hemispherical calcareous projections in size from 12 to 18 inches diameter,—a sketch of one is appended.*

In the bed of the river in several places I found masses of Lignite, it is of a jet black color, and from its frequent occurrence has no doubt been instrumental in giving the reputation to the Godavery river, as being a coal producing district. It does not appear to exist in beds, but in isolated masses in the alluvium from which it is washed out by the action of the river.

One piece was inclosed in the sandy bed of the river, surrounded by heaps of large water worn pebbles, with which it could never have been transported on account of its extreme friability, the central portion is silicified and preserves apparently the structure of the original wood from which it has been converted, the outer coating is the lignite in various states of carbonization, part being brown

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* Vide Plate III.

and preserving the original texture of the wood, and still even flexible, whilst other portions are completely converted to a substance having all the appearance of coal. The silicified nucleus is traversed by veins of iron pyrites. Great numbers of these silicified pieces of wood are met with, in every part of the bed of tne river.

In the Tal river, a small tributary of the Godavery, running into it near Lingala, I observed in my return journey,—the debris of a slaty coal, not in isolated masses, but thickly scattered over the river bed, it had been washed from its position in the banks or in some of the nullahs of this river.

It was unfortunate that this material did not come to my notice earlier ; as it would have been very desirable to make some examination of the district, through which the Tal runs, the monsoon rains hovever had commenced on my arrival there and rendered an expedition into this unexplored district impracticable this season.

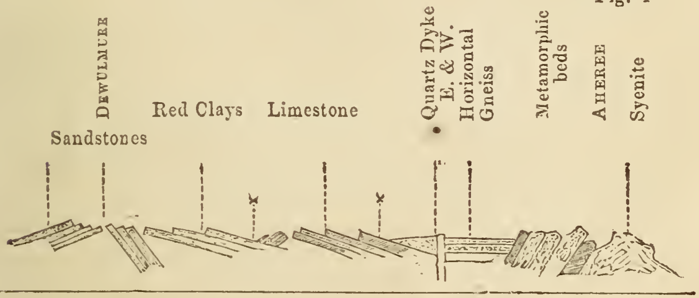
Mr. Tuke in his survey of the Sebbery river mentions the fact of a report that coal exists up that valley, as the Tal river runs into the same line of country that report seems to be confirmed in probability by the finding of the material in the Tal.

The line of fault, before alluded to, as observable along the whole course of the river has a tolerably general direction to the N. E., points of greatest disruption and alteration being observable at the Buddrachellum, Enchampilly and Aheree Barriers ;—at these places the beds are turned up on end, and contorted in every possible manner,—at the intermediate places the whole masses of country seems to have been upheaved, the beds preserving a tolerably horizontal position ; this feature is well observed in the hills south of Dewulmuree, where the strata can be traced running in horizontal lines from hill to hill, the intervening valleys having been formed by the washing away of portions of these beds ;—towards the lower part of the river, at Kota and also at Albaka the beds have an inclination downwards from this line of fault, so that, in travelling in a north easterly direction from the river, a recurrence of the series described, or portion of it, may be expected to be again met with. I

was informed by Dr. Jerdon who had just traversed this country that he had there seen ferruginous sandstone of great thickness, and also that it contained some thin seams of coal.

The river bed at Dewulmuree is entirely composedof altered rocks, inclined at a very high angle, amongst them the Kota limestone and its accompanying red clays can be clearly made out, also in the jungle path between Dewulmuree and Aheree, they are again seen much broken up and disturbed—(Fig. 1) is a section taken along this road.

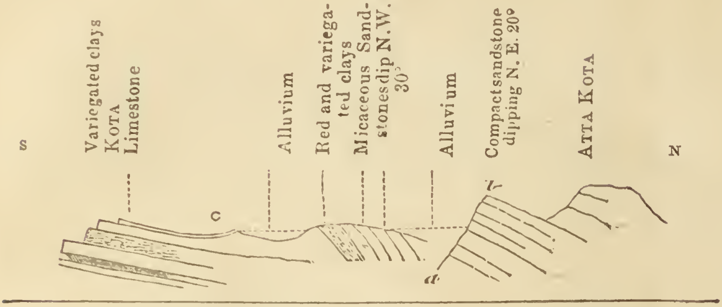
Fig. 1



In the papers published in the transactions of the Geological Society* on the Geology of the neighbourhood of Nagpore, it is stated that the Godavery sandstones extend into the district around Nagpore, the series there detailed is ferruginous sandstone, laminated sandstone, clay shale and limestone, the limestone being the lowest in the order of superposition, according to this description the series at Nagpore can hardly be identical with that of the Godavery as it will be observed that the relative position of the sandstone, and limestone series is reversed at Kota, the limestone being uppermost. I observed in the hills above Kota to the N. E. or deep of the limestone, beds of sandstone, but I considered the evidence tolerably conclusive of their being upheaved and not overlying beds, being on the opposite side of the line of fault I have before alluded to, to that of the limstone.

* In *Quarterly Journal, Vol. XI. Pt.* 3,

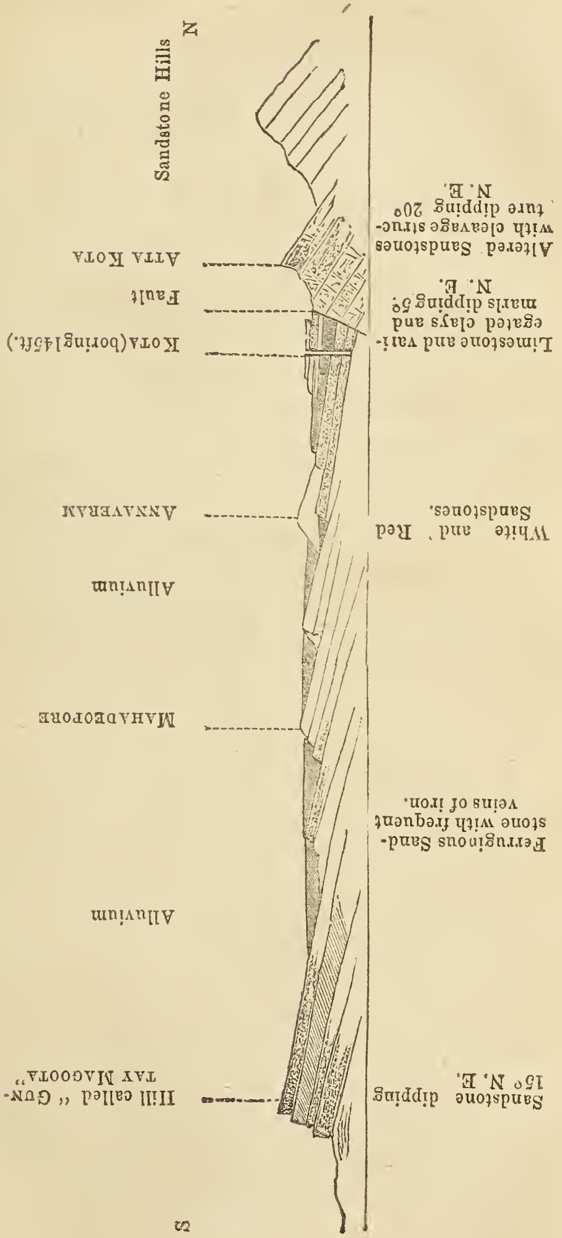
The following is a section of the beds as exposed along the river from the limestone at Kota northwards.



The sandstone at *a b* has a distinct cleavage structure running across the planes of stratification inclined 10° to the W. it is very close and compact, but still preserves its granular texture, the face *a b* is scored and polished, the beds seen at Atta Kota have the same dip but are less compact, this sandstone forms the range of hills to the north of Kota.

At C, the beds of limestone become horizontal and subsequently dip in an opposite direction to their general inclination, there is here a thin bed of laminated or micaceous sandstone.

SECTION ACROSS THE VALLEY OF THE GODAVERY RIVER FROM MAHADEOPORE HILLS TO KOTA, LENGTH 20 MILES.



XII. *On the Oxymel process in Photography. By* J. Tawse, *Madras.*

My difficulties with Oxymel have been of two kinds, and which from what I have heard I believe are very generally met with in this country.

The first of these was rather humiliating in its nature. After a picture had been obtained sometimes at a considerable distance from my place of residence, on proceeding to wash the plate after the development the entire film of Collodion came away in sections leaving nothing but the bare glass. I was at first inclined to attribute this to a peculiar state of the Collodion, or to an acid bath which I was told was productive of this consequence. The Collodion used however was successively Hockin's, Thomas's, and Horne's, and my bath when I first commenced was perfectly neutral to test paper. It then occurred to me to roughen the margin of the plate not simply on the edges but on a space $\frac{1}{8}$ of an inch all round as has been recommended by Mr. Hardwich. This succeeded admirably, the film adhered perfectly during repeated and violent washings.

The second difficulty I experienced in the production of a negative picture was the want of intensity. I followed the details of Mr. Llewellen's process minutely, but in each case the result was a pale picture, showing ill as a positive and at the same time too weak to print. After repeated experiments I find that the remedy for this is as follows, I must first premise that the developing solution I use is the following :

Pyrogallic Acid	1 grain
Glacial Acetic Acid	20 ms.
Alcohol	10 ,,

As soon as the plate is taken out of the frame it is immersed for an instant in distilled water, and then placed on the levelling stand. A rapid washing so as merely to wet the film is all that is required,

the small quantity of organic matter remaining on it tending to give density. The picture is then to be brought out in the usual way, but in this process I find that a large quantity of a 40 grain solution of Nitrate of silver is required before the image will appear, viz. about 5 or 6 drops to the drachm of the developing solution. The developer at this stage should not be applied further than is necessary to bring out all the details of the picture. When this is done I wash the plate well with common water and then treat with Cyanide of Potassium. The picture is now a bad positive and requires deepening. This is done by washing the Cyanide well off the plate, and then again carrying on the development with Pyrogallic Acid and Nitrate of silver, rocking the plate to and fro to make it flow evenly over its surface. The high lights immediately deepen into beautiful blacks, while the dark shadows should remain clear and free from any deposit of Metallic silver.

In my first experiments with Oxymel, I developed at once before fixing, and invariably got a certain degree of foggyness in the dark shadows which whitened them to such an extent that they were almost opaque and required a long exposure to print on paper. Two of the negatives produced at the last meeting were of this character.

The process is extremely easy in all its details. The following formulæ are I find the best in this climate.

Bath.

Distilled Water.................. 1 oz.
Crystallised Nitrate of Silver..... 30 grains.

saturated with Iodide of Silver in the usual way. The proportion of Iodide of Potassium I have used for this purpose is 5 grains to 20 oz. of the silver solution. After filteration I add to every 20 oz. of the Bath 10 minims of glacial Acetic Acid. This I find tends to preserve the clearness of the pictures under the developer.

The Collodion must of course be what is commonly used for negatives.

In this process many failures are due to the bad quality of Oxy-

mel used. It is frequently very dark in color owing to the large quantity of wax always present in inferior honey.

After the plate has been washed for a little in distilled water after being excited in the bath, it is to be plunged into a flat dish containing enough of the Oxymel bath to cover it. This bath is prepared as follows, and may be used repeatedly.

Oxymel................	1 oz.	Filter.
Distilled Water..........	4 ,,	

The plate is left in this bath for a minute and is then well drained before being placed in the Camera frame. The plates will keep perfectly well for a week in this climate even during hot weather.

The exposure is long, viz. with a Ross' 4 inch landscape lens and ½ in diaphram as much as 9 or 10 minutes will be needed to bring out dense foliage. But this process has one advantage over others on Collodion, viz. that provided a sufficient length of exposure has been given, no ill effects follow from over exposure, as the picture seems to correct itself in the development, fogging being prevented by care being taken not to carry the first development too far.

The picture is then washed and dried in the usual way, and finally varnished.

SELECTIONS.

Thwaites' New Cinghalese Plants.

No. II.

On TETRACRYPTA *and* KOKOONA, *Genera of Ceylon Plants; by* G. H. K. THWAITES, ESQ., *Superintendent of the Royal Botanic Gardens, Peradenia, Ceylon.*

(With two Plates, TAB. IV. V.)

I. TETRACRYPTA, *Gard. et Champ.* Nat. Ord. Hamamelideæ? (*Anisophyllea*, Br.; *Anisophyllum*, Don.)

Tetracrypta *cinnamomoides*, Gard. et Champ. *in Hook. Journ. Bot. et Kew Garden Misc. v.* 1. *p.* 314*. Anisophyllum Zeylanicum, *Benth. in Niger Flora, p.* 342, *et Appendix, p.* 575. TAB. IV.

HAB. Mountains of the Central and Western Provinces of Ceylon; alt. 3000 ped. Herb. Hort. Bot. Reg. Perad. n. 2205. Nom vern. "*Wellepeyenna.*"

Arbor ramosa 40-50-pedalis, cortice lævi. *Rami* inferiores horizontales, superiores suberecti; ramulis appresse puberulis. *Folia* disticha, coriacea, breve petiolata, lanceolata, cordato-acuminata,

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* The generic name has occasioned a great deal of confusion. Brown first proposed the genus, for a West African species that yields a large edible fruit (in Hort. Soc. Trans. vol. v. p. 446), under the name of *Anisophyllea*, but gave no description. Don, in his West African collections, applied the name *Anisophyllum*, Don, MSS., to the same plant. Mr. Bentham, in the Niger Flora, took up Don's name for the West African plant, referred it doubtfully to *Rhizophoreæ*, and added in a note a description of the Ceylon species drawn up from Mr. Walker's specimens. In the same year, or perhaps the previous year, Gardner and Champion published *Tetracrypta* in the 'Madras Journal of Science' we believe, and subsequently in the Kew Garden Miscellany, and referred it to *Hamamelideæ*. In the supplement to the Niger Flora Mr. Bentham points this out, and states that the name *Anisophyllea* of Brown has the priority.

basi angustata, 5-nervia, utrinque glaberrima ; juniora rubra ; paria vernatione opposita dissimilia squamæformia, unico 5-nervi marginibus involutis demum explanato foliaceo, altero 1-nervi plano stipulam referente cito deciduo. *Racemi* supra-axillares, solitarii v. gemini, strigoso-puberuli. *Flores* parvi, subsessiles, bracteati. *Bracteæ* minutæ. *Calycis limbus* superus, 4-fidus, lobis acutis, valvulis persistentibus. *Petala* minuta, carnosula, laciniata, æstivatione induplicativa, segmentis 5 linearibus subulatis. *Stamina* 8, alterna breviora, filamentis subulatis calyce insertis ; antheris versatilibus longitudinaliter dehiscentibus. *Styli* 4, erecti, conico-subulati ; stigmatibus capitatis. *Ovarium* 4-loculare ; loculis 1-ovulatis ; ovulis pendulis anatropis. *Fructus* indehiscens, abortu 1-spermus. *Semen* pendulum, albuminosum ?

This is a handsome tree, 40 feet and upwards in height : its *wood* is very hard and valued by the Cinghalese for building purposes. *Young stems* and *leaves* downy, of a bright-red colour. The dissimilarity in the pairs of young leaves is very remarkable, one being flat, single-nerved, and soon falling away, whilst the other is five-nerved, has involute margins, grows rapidly, and is carried up by the elongating stem to some distance above the smaller one. *Old leaves* coriaceous, distichous, alternate, shortly petioled, 3-4 inches long, 1 inch broad, lanceolate, tapering to a long narrow blunt point : nerves five, strong, parallel. *Racemes* single or in pairs from the upper part of a large scar, which extends upwards from the axil of the leaf, pendulous or nodding, 1-1½ inch long, pubescent, eight-to twelve-flowered. *Flowers* nearly sessile, with small bracts, white, 1 line long, pubescent. *Calyx* of four valvate coriaceous green lobes. *Corolla* of as many small incurved white petals, seated on the calyx, split below the middle into subulate laciniæ. *Stamens* eight, alternately longer and short ; filaments subulate ; anthers versatile ; pollen minute, elliptical, with a dark

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Under these circumstances we have thought it desirable to retain the name *Tetracrypta*, both because it was accompanied with the first published account of the genus, and because it was the only one to which Mr. Thwaites appears to have had access.

central line. *Ovary* inferior, four-celled, with four erect styles and small capitate stigmas; cells with one anatropous ovule, pendulous from the summit of each. *Fruit* coriaceous, grooved, elliptical-ovate, with a narrow top and persistent calyx, one-celled, with one pendulous seed, which has only been collected unripe, but appears to be albuminous and to have an axile embryo.

PLATE IV. Fig. 1, 2. Very young leaves and stipules in vernation. 3. Flower. 4. Vertical section of the same. 5. Petal. 6. Stamens. 7. Transverse section of ovary. 8. Branch and nearly ripe fruit. 9. Vertical section of immature fruit. 10. Ditto of nearly ripe fruit:—*all but fig.* 8 *and* 10 *magnified.*

II. KOKOONA, *Thw.*, gen. nov. Nat. Ord. Hippocrateaceæ.

Gen. Char. Calyx brevis, persistens, margine 5-lobo. *Petala* 5, æstivatione contorta, firma, concava, glanduloso-punctata, decidua. *Stamina* 5, petalis alterna; filamentis basi disco glanduloso immersis; antheris oblongis, introrsis, longitudinaliter dehiscentibus. *Ovarium* disco immersum, 3-loculare, loculis 4-ovulatis; ovulis biserialibus, adscendentibus, anatropis. *Stylo* brevi, conico; stigmate capitato, 3-lobo. *Capsula* 3-locularis, loculis 4-spermis. *Semina* late alata, exalbuminosa, erecta; embryone orthotropo, cotyledonibus planis, radicula infera.—Arbor *ingens, ramosa, cortice rugoso.* Folia *opposita, petiolata, obovata vel retusa, versus petiolum angustata, obscure remote crenulata, lævia, coriacea, subtus minute glanduloso-punctata, stipulata.* Stipulæ *minutæ, coloratæ, acutæ, subpersistentes.* Inflorescentia *paniculata, axillaris.* Bracteæ *minutæ.* Flores *pedicellati, læves.*

Kokoona *Zeylanica*, Thw. TAB. V.

HAB. Central provinces of Ceylon, Ambagamowa district; elev. 4000 feet. Herb. Hort. Reg. Bot. Peradeniensis, No. 2584.

A large forest-tree, 60 feet or upwards in height, much branched especially towards the top. *Bark* rough, when cut of a yellow colour, somewhat corky. *Leaves* dark green, smooth, underneath paler, with very numerous minute dark red glandular dots. *Stipules* very minute, deep red, subpersistent. *Panicles* axillary, raceme-like. *Bracts* very minute, acute. *Flowers* dull yellowish-

brown. *Calyx* minute, with five shallow lobes, persistent. *Petals* five, concave, firm in texture, with minute pale glandular dots on the inner surface, twisted in æstivation. *Stamens* five, alternate with the petals, inserted into depressions of the dark green angular disc. *Ovary* three-celled, each cell with four ascending anatropal ovules. *Style* short. *Stigma* capitate, somewhat three-lobed. *Capsule* 1·4 inches long, oblong, bluntly triangular, three-valved, three celled. *Seeds* imbricated, winged, erect, exalbuminous. *Wing* very broad, oblong, truncate or blunt. *Embryo* orthotropal; cotyledons flat.

In habit and general appearance this plant resembles the *Celastraceæ*, though it would seem to differ almost as much from members of that natural family as do the *Hippocrateaceæ*, from all the genera of which latter Order it differs in having five stamens.

The yellow bark is sold in the bazaars, and when pounded is used by the Cinghalese as a kind of cephalic snuff, being mixed with ghee and introduced into the nostrils in order to relieve severe headache, by encouraging a copious secretion from the nose.

The native name of the tree is *Kokoon*, which has suggested the generic name.

PLATE V. Fig. 1. Flower. 2. Stamen. 3. Ovary and disc cut longitudinally. 4. Transverse section of the same. 5. Small, immature capsule. 6. Transverse section of the same. 7. 8. Seeds. 9. Branch and stipules:—*all but fig.* 5 *and* 6 *magnified.—Kew Miscel. Vol. V. p.* 378.

Aska Sugar Factory.

My visit to Aska has enabled me to gain much information regarding the manufacture of sugar, while my tour through the country has admitted of my following up an enquiry I begun in Rajahmundry as to the profits from its cultivation. The result of my observations is a conviction that it is, to the interest of Government to encourage the growth of this article to the utmost, and if that is done I am confident that it will become the great crop of

the whole District of Ganjam, yielding, as it will, a profit far exceeding that from any of its other products.

The Aska factory has been raised to its present state of perfection by the most indefatigable energy, through many years of difficulty and loss. It is now in very high order and capable of manufacturing more than 12,000 tons annually, a very much greater quantity of sugar than the District yields at present, and the difficulty it has now to contend against, is the deficiency of supply. If my information is correct, the whole extent of land cultivated with sugar in the District is between 3 and 4,000 acres, which with a fair allowance for loss, occasioned by insufficient means of irrigation, floods, and other accidents, does not yield more than 4,50,000 pots of Goor; sufficient for the manufacture of about 4,500 tons of the fine yellow sugar exported.

The Aska works have not the command even of this supply; there is not only a considerable home consumption, but there is a great demand for sugar in the south of Orissa and in Nagpore which leads to an active competition in the purchase and although the price has been raised lately, and the quantity brought into the factory at the time I was there varied from 4,000 to 5,000 Rupees worth daily, there is still a fear, lest the quantity should be too small to make the work pay a fair profit for the season's working. The lowest quantity of sugar that should be turned out from these works should be 3,000 tons a year; which with the present low farming would be produced on 4,000 acres of land, but with the greater capacity of the Aska Machinery and the native demand for consumption, and export by land, we have evidently a market which can only be supplied by the Government giving every encouragement to the growth.

It would answer well enough for Europeans to take up the cultivation of sugar, as the profit from a manageable area would be sufficient inducement. In this respect it differs from the cultivation of grains and seeds and from cotton also which are produced in so small quantity from each year that the cost of management would absorb too much of the profit, if an European undertook it. Nor has sugar the great disadvantage of being a precarious crop as

Indigo is; only one precaution is necessary; and that in Ganjam is easily provided for, the supply of water throughout the year should be secure. It is difficult to understand why Europeans have not taken up this cultivation, I find that the land will yield an equal weight of sugar with land in the West Indies; there is a market for the produce at hand, and labour to be had at 2 pence a day. Yet the inhabitants of this country are emigrating, and some even going to the West Indies to work on the very same cultivation, with no one single advantage. The whole difference between the two countries that causes this remarkable state of things is that there is capital in the one country, and not in the other.

If English settlers brought their money and intelligence to bear upon this cultivation, Ganjam could, I am convinced, undersell all the great sugar growing countries of the world; but we need not wait for them. There is a population sufficient and as much enterprize as could be expected, and if the Government acting in the capacity of landlord, did all that is in its power to help the cultivators, it might without taking any part in the actual cultivation or advancing money, give such a stimulus to the growth of sugar, as would make it the great staple of the District.

In looking through the expenses of sugar cultivation, I find that there is as much enterprize as could be expected where those who bear the toil and risk, have to pay the profits of their work, to those who supply the capital required. I am told by people of all classes that where the sugar grower works with borrowed money, his cane yields him no better profit than Rice, and those who take up the growth of sugar are very often induced to do so by the trifle of ready money they obtain as an advance from the merchants to secure the crop. The several expenses of a sugar garden are, the cost of the cuttings (or seed cane.) The land Revenue; preparing the land by manuring, &c., watering, and buying or hiring the mill and pans for manufacturing the Goor. The usual size of a garden is about 10 Burnums or 2 acres, the cuttings for which, cost usually 40 Rupees. The Assessment on the land is, I believe, about 30 Rupees; I have an account of the cost of cultivation, but

I do not trust it sufficiently to quote it. The cost of watering depends upon the position of the land, but sites are usually chosen where irrigation can be had a part of the year and where a very shallow well will supply water with the least labour when the irrigation fails. The purchase of cuttings is in most cases the greatest item of expense, and as the money has to be laid out a whole year before the crop is cut, the interest is very heavy upon that portion of the outlay. The Revenue is also taken before the crop is sold, and money has to be advanced on that account. The cost of cultivation having in like manner to be advanced, the land is poorly worked and sparingly manured, and as the cost of watering must be kept down as low as possible for the same reason, land is chosen where water is near the surface, whether it is liable to flood, or is difficult to drain, or in other respects unsuitable for a sugar crop. In short the cultivation generally is carried on under the disadvantages of the very cheapest farming, and as those who lend the money work upon the common Indian principle of taking all that they can get when they have a chance, without reference to the future; the growers find themselves with little profit even in the best seasons, and in case of accident hopelessly in debt. Under such circumstances, it is no wonder that the extension of the growth of sugar is slow, although experiment has shown, that under good farming, the profit from an acre is very moderately estimated at 100 Rupees.

The Government might do something to remove these difficulties, and the European purchasers might also help. The most important step the Government could take would be, to secure a certain supply of water to land suitable for sugar, so as to remove the cost of working wells and make water so cheap, that as much may be given to the cane as it can take up and convert into sugar. This will, if well managed, work favorably in more ways than one. The best land may then be chosen having soil suitable, and being capable of good drainage. In Rajahmundry where the wells were 15 feet deep, working them was so expensive, that a supply of water for an acre from a channel flowing through the year, was considered by the ryots worth 50 Rupees in the saving of labour only; so wells are not used, and the farming altogether is poorer, but the

water would be worth no less ; this estimate, it must be remembered, is made by those who had to pay for the water, and who calculated only the cost of the quantity they raised from the wells, whereas the supply taken from the channels was at least double and it contained a manure not found in well water. In consequence of the very favorable climate of Ganjam in which rain falls in almost every month of the year, and for 7 or 8 months there is a stream in the rivers, the cost of a constant supply of water for the year would be smaller than it is in most Districts, and as the monsoon there is hardly less certain than it is on the western coast, there would be nothing precarious in the supply of water.

The works I would recommend for this cultivation are, annicuts on the considerable streams, and tanks on the smaller tributaries so arranged, that when the river failed, the tank water might be thrown into the channels. The country seems well adapted for works of this kind and the land suitable for sugar, (if such irrigation is given to it) is unlimited. In speaking of this to a wealthy land holder, he thought the plan all very good, but he believed the whole soil of Ganjam to be so peculiar, that " bunds of tanks could never be made of it," I need not say that this was purely imaginary, and Major Birdwood will gladly undertake to prove to the contrary as soon as he has determined on suitable positions for his works, and obtained sanction for the sums required to build them.

Another relief that the Government might give to the sugar growers is to take the Revenue from the land after the crop is sold, holding the land as security ; I am quite aware that there is not one Sheristadar in the service who would not object to this ; and it would be a most unpopular move with the influential people of the country, because it would help to relieve the ryots from the thraldom in which they are held by the capitalists. So much is this mode of relief objected to, that when a gentleman in Rajahmundry offered to pay the kists for the sugar growers, a party of Sowcars offered him 3,000 Rupees not to begin that system. If the security is good, the Government will not, I am sure, object to this innovation ; and I am certain, if it was tried, it would be found

that no native land-owner would allow the field to pass out of his possession that had once yielded him the full profits of a sugar crop. Land let on such favourable terms, and supplied with water for sugar the whole year through, might well be paid for at 15 Rupees the acre ; it would be worth 50 Rupees, but 15 would pay the Government well. Where very high profits are received from the land, as there would be in this case, there will soon be an intermediate man in possession of it who will be the gainer by the reduced Assessment, not the actual cultivator. Even with the Assessment I name, the land would be saleable at a high price, and the man of capital would be the sugar grower ; the cultivator would then be his servant ; paid it may be from the crop, but he would not as now have risked the cost of cultivation. The owner who possesses land so valuable will not only secure its being cultivated, but will see that the right crop is grown, and to do this, his terms with the cultivator must be liberal. I believe that nothing would so certainly lead to a class of wealthy land-owners as an irrigation suited to the growth of sugar, and terms favorable to introduction. And I have not yet seen any province of the Presidency better suited to the plant and its high cultivation than Ganjam.

I have noticed the comparatively large sum required for the cuttings of a new sugar garden, and the want of money for purchasing them will be an impediment to the growth, when the Government has done all that I recommend. I am generally averse to Government attempting any cultivation of its own, simply because my experience leads me to expect that no good will result from it. I would otherwise suggest that a few acres of land should every year be planted with cane to be distributed as cuttings ; I believe that great encouragement might be given by this means, and at no expense as the actual cost under tolerable management would make them very cheap to the purchaser, but the success of this would depend upon those who undertook the management, and I cannot say who has either time or taste for that. I have however suggested this mode of giving an advance, to the owners of the Aska sugar factory and I am perfectly certain that it is worth their while to make the trial.

Before leaving the subject of sugar I must be allowed to call attention to the factory at Aska which is now the centre of a traffic on which the prosperity of a great portion of the Ganjam District depends. The variety of trades and manufactures to which it has given rise can only be understood by following the processes in the factory. But its effect may be in some degree estimated by a consideration of the facts, that the consumption of fuel is about 24,000 Rupees worth annually and 6,000 tons of Goor will, it is expected, be this season purchased from the ryots at a very remunerative rate. If this supply is obtained, more than 3,000 tons of sugar will be shipped, and the profits from the works will be satisfactory. But whether working to the profit anticipated or to loss such as it has hitherto had, it has equally a claim to every help from the Government. The enterprizing owners have run a great risk, and several have met with a loss not liking to go on, in the venture. A capital has been sunk which would have made no insignificant appearance in our list of Public Works; very few of which indeed approach the Aska factory in cost, and it is more directly beneficial than almost any thing that has been done by the Engineer Department, excepting only our largest irrigation works, from the sum it annually circulates in the District and which will this season nearly equal in amount half the Revenue of the Collectorate. I am induced to offer these remarks because I have met with a feeling here and there that such great works might very well be left to themselves. There is a very common notion that great manufacturers make great profits, and can fight their own battle and moreover that they have rather a too determined way of asking for what they want. This may be true in some cases, and I hope it may be so with the Aska manufacturers. Their success will be a most valuable example; they will deserve all they earn, and if their demands are always as reasonable as they now are, they cannot be too resolute in making them. What they most want are, encouragement to the growth of sugar, and such fine roads elsewhere as that which has been opened to their benefit, between Aska and the port of Moonsoorcottah.—*Observations made on a tour in Ganjam, in March and April* 1856.—*By Lieut. Col.* F. C. COTTON.

On Wood Oil.

The Balsam obtained from various trees of the order DIPTEROCARPEŒ.

The value and importance of this article of Indian produce invests all information existing on the subject with much local interest.

Up to a recent period it appears to have been little known in the Home market at least as far as regards its medicinal properties.

In 1854 Mr. CHARLES LOWE, Assistant in the Royal Institution, Manchester brought it to the notice of the Pharmaceutical Society, under the description of "*A new variety of Balsam of Copaiba*" in the following terms :

"An organic fluid was lately placed in my hands by Mr. Grace Calvert for examination, which he had received from an oil merchant of this city, who stated that all he knew of the substance was, that it was obtained by the incision of a certain tree growing on the coast of *India*. From the characters it presents I have ascertained it to be a balsam of copaiba, but as it differs in some of its properties from other balsams that I have examined, I forward you the following notice, in hopes that it may prove interesting to some of your numerous readers.

In appearance this balsam of copaiba is dark coloured and turbid. Its turbidity is due to a greenish resinous matter, held in suspension, which is, however, easily separable, either by filtration or deposition, leaving a brown transparent liquid of sp. gr. 0.970. When the latter fluid is submitted to a careful distillation it yields :—

Essential oil........................	65 per cent.
Resin.......	34 ,,
Acetic acid and water...........	1 ,,
	100

I find that the essential oil in its various reactions with potassium, iodine, nitric acid, &c., and moreover in taste, exactly corresponds with those presented by pure essence of copaiba. The resin left by distillation of the balsam, either with or without water, is, if deprived of the whole of the essential oil, extremely hard. Its entire solubility in coal naphtha proves the absence of any of the soft resin which exists in most of the

copaiba of commerce. This hard resin (copaivic acid) being most probably the active principle of balsam of copaiba, I am induced to think its quantity and purity in the one I have examined is indicative of its superior value as a medicament. The dark colour of the balsam may perhaps limit its employment, but the large quantity of copaivic acid it contains renders it valuable, as the latter may be made available by heating the filtered balsam to the boiling point with a small quantity of caustic potash or soda lye, of sp. gr. 1.34, and separating the resinate of potash or soda from the essential oil. The alkaline resinate may then be dissolved in water, giving a colourless solution (similar to Frank's specific), or the balsam may be treated with magnesia to form the ordinary copaiba pill.

I have in conclusion remarked :—

1st, That the essential oil obtained by the distillation of balsam of copaiba has, like several other hydrocarbons, the property of dissolving indigo.

2ndly, The new variety of balsam above described presents the curious property of becoming gelatinous (so much so that the tube may safely be inverted), if heated to 230° Fah., even if a *sealed* tube be employed. This character being dissimilar to the one given in the same circumstances with such other balsams as I had at my disposal, I am induced to attribute it to the large amount of " *hard* resin" it contains.

3rdly, Balsams of copaiba in general give, on distillation with two per cent. sulphuric acid, a beautiful blue volatile oil. Chlorine, hypochlorite of lime, and bichromate of potash, give a similar character with the balsam, which appears to me to be due to the oxidation of the hard resin, as I have been unable to obtain but a small proportion of the blue-coloured oil when I employed a balsam containing " *soft* resin," comparatively to when I made use of the one above described, which, as I have already remarked, contains only " hard resin." A further support of this view is, that pure essence of copaiba assumes no blue colouration when distilled as above.

4thly, That cold sulphuric acid produces a purple colouration with balsam of copaiba, similar to that obtained by its action on cod-liver oil. Such being the case, it is probable that a small quantity of it, mixed with olive or some other oil, may be sold by unprincipled persons as genuine cod-liver oil.—*Pharmaceutical Journal,* XIV. 65.

In 1856 the same substance was again noticed by Mr. DANIEL HANBURY under its ordinary name of *Wood Oil, a substitute* for *Copaiba.*

" Among the drugs that have recently appeared in the London market, I have observed one article to which I am desirous of drawing attention. It is a liquid imported in considerable quantity from Moulmein in Burmah, and offered for sale under the name of *Balsam Capivi,* but known in India as *Wood Oil* or *Gurjun Balsam.*

To Balsam of Copaiba, however, it presents so remarkable a resemblance, that, but for the locality from which it was imported, it would hardly have been noticed as anything else than Copaiba of rather unusually dark colour.

In the Paris Universal Exhibition there are two samples of a similar liquid, labelled *Wood Oil,* one of them being sent among the Materia Medica of Canara, the other from the Tenasserim provinces. Through the kindness of Dr. Royle, specimens of each have been placed at my disposal. Though comparatively a new drug in English trade, *Wood Oil* is an article of common occurrence in the bazaars of India.

From its similarity to Copaiba, it might be supposed to have its origin in some plant nearly allied to *Copaifera:* such, however, is not the case, it being the produce of the natural order *Dipterocarpeæ.*

The following is Roxburgh's account of the manner of obtaining it from *Dipterocarpus turbinatus,* an immense tree, native of Chittagong, Tipperah, Pegue, and other places to the eastward of Bengal.*

' This tree is famous over all the Eastern parts of India and the Malay Islands, on account of its yielding a thin liquid balsam, commonly called *Wood Oil,* which is much used for painting ships, houses, &c.

' To procure the balsam, a large notch is cut into the trunk of the tree, near the earth (say about 30 inches from the ground), where a fire is kept up until the wound is charred, soon after which the liquid begins to ooze out. A small gutter is cut in the wood to conduct the liquid into a vessel placed to receive it. The average produce of the best trees during the season, is said to be sometimes 40 gallons. It is found necessary, every 3 or 4 weeks, to cut off the old charred surfaces and burn it afresh; in large healthy trees abounding in balsam, they even cut a second notch in some other part of the tree, and char it as the first.

' These operations are performed during the months of November, December, January and February. Should any of the trees appear sickly the following season, one or more years' respite is given them.'

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* *Flora Indica* (ed. Carey) vol. ii. p. 613.

The same author also states that Wood Oil is afforded by *D. costatus* (*D. angustifolius* W. et A.), *D. alatus* Roxb. and *D. incanus* Roxb., the last mentioned being reputed to furnish the largest proportion of the best sort.

Closely allied to the Wood Oil of *Dipterocarpus* is the oleo-resin termed *Camphor Oil*, produced by *Dryobalanops Camphora* Colebr., a tree of the same natural order. For a specimen of this oleo-resin and of an analogous liquid called *Lagam Oil*, both brought from Sumatra by Dr. Junghuhn, I am indebted to the courtesy of Dr. J. E. De Vrij of Rotterdam.

Wood Oil, as imported from Moulmein, is after filtration, a transparent, dark brown liquid, of somewhat greater consistence than Olive Oil, a sp. gr. of .964 and an odour and taste like copaiba, though perhaps hardly so strong. One part of it treated with two parts of alcohol sp. gr. .796, is dissolved with the exception of a minute quantity of darkish flocculent matter, which subsides upon repose.

But its most curious property (as noticed by Mr. Charles Lowe with reference to a liquid which I suppose to have been *Wood Oil**) is that exhibited when it is heated in a *corked* vial to about 266° F. (130° C.)† Thus treated, it becomes slightly turbid, and so gelatinous that the vial may be inverted, even while hot, without its contents being displaced; and on cooling, the solidification is still more complete. Gentle warmth and agitation restore to a great extent its fluidity, but solidification is again produced upon the liquid being heated to 266°. Copaiba displays no such phenomenon.

According to Dr. O'Shaughnessy, when Wood Oil is heated in a retort, a yellowish white, *crystallizable*, solid substance having many of the properties of benzoic acid sublimes into the upper part of the vessel, to the extent of about one per cent. of the Wood Oil taken. In my own experiments, I have not detected any of this substance. It is true that when Wood Oil is heated, a scanty, opaque white sublimate condenses in the cooler part of the vessel, but this appears to arise from the condensation of a little water among the minute drops of essential oil, since it is not produced if the Wood Oil has been previously agitated with some fragments of dried chloride of calcium.

With regard to its medicinal properties, there appears to be no doubt

* On a new variety of Balsam of Copaiba, *Pharmaceutical Journal*, vol. xiv. pp. 65, 66.

† Mr. Lowe says 230° F., but a much more striking effect is produced on the *Wood Oil* by the temperature I have named.

from an extensive set of experiments instituted by Dr. O'Shaughnessy, confirmed by trials made by other practitioners in India, that Wood Oil is nearly equally efficient with Copaiba, in the diseases in which that drug is indicated.* It may be administered as an emulsion, or in pills made up with magnesia. Dr. O'Shaughnessy has used the essential oil in doses of from 10 to 30 drops.

From the close similarity of Wood Oil to Copaiba, a mixture of the two may be anticipated; from pure Copaiba, such a mixture will probably be detected by a difference in its optical properties."—*Pharmaceutical Journal*, XV. 321.

Still *later* "*a note*" appeared in the same serial translated from a paper by Mr. GUIBOURT, in the French *Journal de Pharmacie et de Chimie* for September 1856, which we here reproduce;

"This curious Indian production, named by the English *Wood Oil* or *Gurjun Balsam*, has already formed the subject of two notices† published in the *Pharmaceutical Journal and Transactions*, by Messrs. Charles Lowe and Daniel Hanbury.

Mr. Lowe, who knew merely that this resinous liquid is extracted in India from incisions made in a tree, considered it Balsam of Copaiba rendered turbid by a greenish resin suspended in it. [He found that] the filtered balsam formed a brown transparent liquid, which yielded by distillation as follows:

Essential Oil	65
[Hard] Resin	34
Acetic Acid and Water	1
	100

According to Mr. Lowe, the volatile oil possesses all the characters of that of copaiba; and the "*hard* resin," which he regards as pure Copaivic Acid, exempt from the "*soft* resin" which, according to him, exists in the greater part of the copaiba of commerce, appears to him indicative of superiority as a medicine. I must acknowledge that I but ill comprehend this conclusion, and that I am the less convinced of the identity of the hard resin with copaivic acid, since Mr. Lowe has recognized in the new resinous balsam the singular property of becoming solid when exposed in a closed vessel, to a temperature of 230° F. Copaiba presents no similar phenomenon.

I find stated moreover this difference, viz., that the new balsam distilled

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* *Bengal Dispensatory* (1842) pp. 222—224.

† The two selections from the *Pharmaceutical Journal* given above.—ED.

with the addition of a small quantity of oxidizing agent, as chlorine, hypochlorite of lime, or bichromate of potash, yields an essential oil of a fine blue, whilst ordinary copaiba containing "*soft* resin" (I still scarcely understand), affords hardly any coloured essential oil. The notice concludes with pointing out a possible sophistication which appears to me little to be feared; it is, that cold sulphuric acid produces with copaiba a purple colouration similar to that obtained with cod-liver oil, so that, as the author supposes, dishonest persons might substitute for the latter, a mixture of olive oil or of some other fatty oil, mixed with a small proportion of copaiba.

Mr. D. Hanbury informs us in his notice, that Wood Oil is extracted from *Dipterocarpus turbinatus* by a very peculiar process, which I will state in a few words, in order the better to show the nature of the product. To obtain the oil, a large incision is made in the trunk of the tree at about 30 inches from the ground, on which a fire is lighted and kept up until the incision is charred: soon after this, the liquid begins to flow. It is conducted by a little trough into a vessel placed to receive it. The average produce of one of the better trees in a single season, is 30 gallons. Roxburgh [from whom this account is taken] adds that *Wood Oil* is also produced by *Dipterocarpus incanus*, *D. alatus*, and *D. costatus*. The first of these three is reputed to yield the best sort, and in the greatest quantity.

The Wood Oil which forms the subject of Mr. Hanbury's notice has been imported in large quantity from Moulmein in Burmah: when filtered, it is a transparent liquid of a somewhat dark brown when seen by transmitted light, but appearing opaque and of an obscure green if viewed by reflected light. It possesses therefore, in a very marked degree, the dichroism observable in all resin-oils obtained by the action of fire. I particularly notice this character which determines the nature of Wood Oil, and shows that it is not simply a natural product like Copaiba; but that it is in part the result of a liquid modification of the *Dipterocarpus* resin, effected by the agency of heat. This Moulmein Wood Oil is of somewhat greater consistence than Olive Oil; it has a sp. gr. of ·964, and possesses an odour and taste very analogous to those of copaiba. It dissolves in twice its weight of absolute alcohol, with the exception of a minute residue which is deposited upon repose.

But the most curious property of this oil, already recognized by Mr. Lowe, and afresh observed by Mr. Hanbury, is that of solidifying when heated in a closed vial to 266° F.; at this temperature the oil becomes turbid and so gelatinous, that it is not displaced upon the inversion of the

vial. After cooling, the solidification is yet more perfect; but a gentle warmth, assisted by slight agitation, restore its former liquidity. Mr. Lowe has given the temperature of 230° F. for the solidification of the oil: I suppose that the different temperatures noted by these two observers may be accounted for by some difference in the liquids on which they operated; for as the sorts of copaiba furnished by different species of American *Copaiferæ* and the turpentines by various pines and firs, are not identical, so we may reasonably conclude that the Wood Oils yielded by various species of *Dipterocarpus* are not absolutely similar; the greater or less degree of heat to which the oil has been subjected in the process of extraction, may also cause a variation in the properties of the product.

What I assert here is not a matter of supposition, but at present of certainty. At the Universal Exhibition of 1855, there were two samples of Wood Oil, the one sent from Canara, the other from Tenasserim. One of these samples (I do not know which), enclosed in a small white earthen pot, which in fineness of paste was midway between stone-ware and porcelain, had been given by Dr. Royle to M. Delesse, the member of the international jury who had been commissioned to report upon the bitumen and petroleum forwarded to the Exhibition. M. Delesse not finding it to be what he was seeking, sent me the specimen, which I judged at once must be the new copaiba announced by Mr. Lowe. In fact, it approached much nearer to the balsam examined by Mr. Lowe than that which has been presented to me by Mr. Hanbury.

The Wood Oil of Mr. Hanbury has almost the liquidity of Olive Oil; held up to the light of the sun, it is seen to be perfectly transparent, and of the colour of dark Malaga wine: seen by reflected light, it appears opaque, and of an olive green. With ammonia and magnesia, it behaves in a very different manner from Copaiba. Mixed with liquid ammonia 22° B., in the proportion by weight of 5 parts of Wood Oil to 2 parts of alkali, it immediately forms an opaque and very thick mixture, which does not alter by keeping.

It does not solidify upon the addition of a sixteenth of its weight of calcined magnesia, and the two bodies separate upon repose.

The Wood Oil of M. Delesse has the appearance of a thick and slightly gelatinous liquid. After having deposited a small quantity of green resin which was suspended in it, it became almost transparent: placed between the eye and the sun, it is seen to be of a pure deep red: viewed by reflection, it still appears red, but turbid, and resembles a liquid in which finely-powdered Cochineal might be suspended. The complimentary colour of

red is not therefore apparent by this means, but it becomes manifest when after agitation, a thin layer of liquid covers the upper sides of the bottle. Then, in whatever way we look at this thin layer, it appears of a beautiful green hue.

This same green colour appears again and remains, when, after having dissolved the Wood Oil in alcohol, the solution is left to spontaneous evaporation : one may then see towards the upper part of the capsule, between the portions of green resin, white starry tufts which are due to a peculiar principle, the future examination of which I leave to those who have a larger quantity of the liquid at their disposal. As to the resin, it has acquired a permanent green hue, which is also perceptible in the dry resin which remains after the Wood Oil has been boiled for a considerable time with water. This green colour, which is that also of the beautiful Piney Resin (*Vateria Indica* L.) that was shown at the Exhibition, establishes a point of relation between two products originating in trees belonging to the same family, that of the *Dipterocarpeæ.* But there the resemblance stops, for the resin of *Vateria Indica* is insoluble in alcohol, and very imperfectly so in ether, whilst the green resin of Wood Oil is easily soluble in either of these menstrua. Finally, the Wood Oil of the Exhibition behaves as Copaiba, when treated with ammonia or calcined magnesia. With one sixteenth of calcined magnesia it very speedily solidifies, and a mixture of it with ammonia becomes liquid, and almost transparent, after an instant of opacity.

I am far from concluding with Mr. Lowe, that the two oleo-resinous bodies [Copaiba and Wood Oil] are chemically identical ; but as regards their employment in medicine, I think, as in the case of bodies of analogous composition, such as turpentines and balsams, liquid or solid, all their vegetable components may be of use as a remedy for a catarrhal condition of the mucous membranes. I may remark, in conclusion, that Mr. Hanbury's Wood Oil, and that from the Exhibition, have probably not been extracted by a similar process. It seems to me that the former has been obtained by the action of fire in the manner described by Roxburgh ; the latter has doubtless been obtained without the intervention of this agent, for I do not find in it the indication which characterizes oils that are the result of the action of fire upon resins."—*Pharmaceutical Journal, XV.* 332

The foregoing extracts show how valuable an article of commerce these oils which are largely produced both in India and Pegu are likely to become when they shall have obtained the amount of attention they deserve.

SCIENTIFIC INTELLIGENCE.

Appearance of Coal at Nellore.

(Extract of a letter dated February 4th, 1857 from G. POWELL, Esq. Assistant Engineer N. D. to Col. FABER, Chief Engineer, Madras.)

"I proceeded to the Caligherry Talook of Nellore in order to procure if possible, some more coal, from or about the locality where, in 1856 I found a piece of tolerable good quality. * * * * * * * * * *

* * * * I have found in four different spots, small pieces of a black heavy substance, possessing every appearance of coal: which, from its strong similitude to that matter, I have taken the liberty of calling "*coal*:" and consequently the places from whence I eventually procured it in quantities, "*Seams*:" to each of which, for the sake of reference, I have attached a letter, Ex : Gr : *Seam A. Seam B.* &c., leaving however its merits and quality to be judged of and proved by a more competent authority, for which purpose, I collected a small quantity from each *Seam*, and have yesterday despatched two coolies to your Office, with samples of the various sorts found, together with their accompanying clays, crystals, sandstone and limestones : having at the time of collection carefully noted by an inclinometer, their dip and strike. In some instances however owing to the variety of directions in which the coal lay, I could obtain no positive dip or strike but was obliged to take an average one by noticing the angle and direction which the majority had.

"With the exception of one specimen called "*coal in laterite*," the whole has been collected from within a circle of about five miles diameter of which, a village called Yapanapy, (three miles North East of Caligherry) may be considered as the centre.

"The position of the various "*Seams*" is as follows. *Seam A.* is about half a mile due North of Yapanapy, in the South bank of a nullah, which forms the Southernmost supply channel of the Chinnacranca tank and running nearly due East and West passes half a mile North of Yapanapy. *Seams B. C.* and *D.* are in the banks of branches of the same nullah : but these run nearly midway between Yapanapy and a village called Polumpaud. It was I believe, between the latter, and a village called Iyapareddypollium where I found the coal in 1856 ; which I imagine must have been detached and carried some considerable distance, from its bed in one of these nullahs, by the water which usually flows down them in the monsoon season.

" From a few samples I have seen of various stones said to have been brought from the Oodagherry Talook ; and from the report of Natives, I should consider that the country in that direction was far superior to the country about here, in a geological point of view. Some of the stones which are said to come from Oodagherry, certainly look very like ordinary mountain lime : but as I am at present without any of the various chemicals requisite for proving limestone, I am unable to speak positively on the point.

* * * Upon showing a small piece of " Blue Mountain limestone," which I generally carry about in my pocket, to a Native while out exploring about nine miles West of the town he informed me, that he had seen stone of the same " caste," either in the hills between Dootaloor and Oodagherry or in the mountains, West of latter town ; and that it was generally used for making images, and pillars of small temples."

We have much pleasure in subjoining the following Report by Mr. Wall, the Mineral Viewer, upon the several specimens forwarded by Mr. Powell.

The minerals are chiefly of volcanic origin, consisting of specimens of chrystallized schorl and mica ; there are also several pieces of sedimentary rocks, micaceous sandstones and cherts, ferruginous sandstone, two or three pieces of chert, probably silicified wood, and samples of nodular limestone or kunkur.

The series indicate a volcanic district with sedimentary deposits, the debris of those in the neighbourhood ; none are at all connected with the occurrence of coal. The black substance looked upon by Mr. Powell as coal is schorl, this substance is readily distinguished from coal by its non-combustible properties.

Besides the minerals enumerated above there is a combustible substance amongst them, asphaltum, this differs much in appearance from coal and when heat is applied to it, it will be found to melt very readily.

The following is a list of the minerals forwarded :—

VOLCANIC ROCKS.

Chrystallized schorl.
Do. mica black and white.
Schorl and mica imbedded in compact quartz.
Granular quartz.
Varieties of granite in a state of decomposition.
Kaolin or decomposed felspar.

Pitchstone.
Asphaltum.

SEDIMENTARY ROCKS.

Ferruginous sandstone.
Micaceous do.
Do. schorl.
Chert.
Kunkur

Amongst the above may be mentioned as of economic value.

Asphaltum.
Kaolin.
Kunkur.

Further search should be made for the Asphaltum if it can be obtained in any quantity.

Further samples of Kaolin should also be forwarded from the district, that of a white color being valuable for pottery.

I have also examined the small pieces of the lumps of coal found by Mr. Powell in 1856. It is slightly bituminous or coking coal, and is of a quality very superior to those samples I have had the opportunity to examine as the production of this country. Had this piece been transported from its position " in situ" by the action of water to the place where found, it is not probable but that a further search would have produced more specimens ; this from Mr. Powell's letter seems not to have been the case.

The most reasonable explanation regarding it seems to be that it is a piece of foreign coal that has been conveyed into the district and accidently dropped.

If however the opportunity offers to Mr. Powell for further search he should do so, along the nullahs in direction towards their rise and towards the part of the country where the sedimentary rocks are to be observed.

I am informed by Dr. Hunter that D. White, Esq , forwarded to him in 1850, from the Tada Talook in Nellore, a piece of coal. Upon examining this specimen now in the Museum of Industrial Arts, I find it to be Lignite ; this substance is met with very frequently in many parts of India, and occurs in the alluvial deposits in isolated lumps, it burns with much flame and smoke, emitting a strong pyroligneous odour, and upon examining the ash after combustion, it will be found to preserve the original form of the material, it is somewhat lighter in weight than coal, the specific gravity of some pieces I met with in the bed of the Godavery was 1·23, whilst that of Coal is from 1·30 to 1·45.

Specimens of Cotton and information desired with a view to the Chemical investigation of the Cotton Plant.

Mr. Mallet, Professor of Chemistry in the University of Alabama W. S. is engaged in investigating the Chemistry, Natural history and Physical condition of the cotton plant, and has applied to the Court of Directors for specimens and information which may enable him to extend his researches to the varieties produced in India.

The following Memo. was at the same time drawn up by Mr. Mallet to serve as a guide as to the kind of information desired by him from those supplying him with specimens.

It would be desirable to have specimens from four or five of the Cotton growing localities of India, differing in soil and climate, those which are most important now, or may be expected hereafter to become so.

Separate analysis should be made of the ash of the following parts of the plant, and specimens will therefore be required of

(1st.) The root.
(2d.) The stem (with smaller branches and twigs.)
(3d.) The leaves.
(4th.) The bole or pod.
(5th.) The seed.
(6th.) The fibre or cotton.

About four pounds of each of these parts (in the *green* state) would be needed, hence a sufficient number of entire plants should be collected to yield at least the above amount of each part.

The total weight of the entire plants clear of earth and in their fresh green state must be stated, they must be weighed free from rain or extraneous moisture.

The specimens should be gathered in dry weather and *just after the bole has fully opened.*

The whole of the root, as of every other organ should be taken, each specimen should then be put up in paper or cotton cloth, and distinctly marked and referred to a list, the marks legible and indelible.

Besides the plants, about four pounds weight of the soil in which they were grown should be also put up in cotton cloth, and similarly labelled, carefully *referring* to the plants taken therefrom.

Information as to the following points accompanying the specimens would be very important and valuable.

(1st.) Nature and depth of the soil as to dryness or moisture retentiveness, what other crops are grown in it, is it deemed very fertile, any special weeds ?

(2d.) Geological and topographical character of the District, nature of underlying rock, level above the sea, well or ill-drained naturally ?

(3d.) Climate (especially as regards *rains*, their amount and the seasons at which they fall), is irrigation employed, when and how long in the year ?

(4th.) Kind of seed used and whence obtained.

(5th.) General character of plant whether herbaceous or tree cotton ?

(6th.) Average height of plant and spread of branches, distances from plant to plant ?

(7th.) Average spread of roots in depth and laterally ?

(8th.) Mode of cultivation, time of planting, distance at which plants are placed apart, *amounts of labor bestowed upon weeding during growth* time, of flowering time, of picking, duration of picking, &c., "*ginned*" cotton fibre produced per acre, weight produced per hand employed.

(9th.) Manure used, if any Cotton seed returned to the soil. Stalks allowed to decay on the field.

(10th.) Diseases or ravages of insects to which the plant is subject.

Some samples of the "ginned" cotton ready for market might be useful as affording by comparison with the raw fibre an idea of the degree of care with which the seed is separated. The value of the fibre depends to a very great extent upon the attention given to this mechanical preparation.

Graphite in Travancore.

(Extract of a letter dated Trevandrum, 16th July 1857, from Lieut. General W. CULLEN, Resident at Travancore and Cochin to E. MALTBY, Esq., Acting Chief Secretary to Government, Fort Saint George.)

" In continuation of former* communications on the existence of Graphite in Travancore, I have now the honor to report that I have just returned from a visit to the locality from whence the specimens were procured by me, though presented by Mr. John Loch, for the Exhibition in London in 1851 ; and I have brought in with me upwards of a ton of the ore, and out of which I ex-

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* Vide p. 257, Vol. I. No. II. N. S. of this Journal.—ED.

pect with ease to select at least 10 or 12 cwts. perhaps more, which will be nearly if not entirely pure and free from laterite, clays or particles of quartz, and from which I hope that a fair estimate may be formed of its commercial value, when the working of the mine is properly conducted.

" The plumbago deposit is at a place called Ponalaul in the Oolamalakul Property about 10 miles from Trevandrum in a North East direction on the road to Areenaud. It is found in a rather loose gravelly laterite, and 4 or 5 feet below the surface.

" A hole of about 15 to 20 feet diameter and about 4 to 5 feet deep was first sunk to the plumbago which appeared to form a nearly horizontal layer of from 1 to 2 feet in thickness, but its breadth was not correctly ascertained. Having laid open the whole surface of the plumbago in the pit, and as it seemed to tread in a South West direction, a trench B C was dug from the well at B towards C about 18 feet long and 3½ to 4 ½ deep until the plumbago vein or deposit was again met with, and it was traced as far as C where a narrow trench was dug at right angles to B C, and the Graphite was there again found. From the limited area exposed in the original pit about 1¼ ton of Graphite was obtained. The deposit appeared to be extensive and traces of Graphite were also discovered in other holes sunk at various distances from the main deposit. The total quantity of crude or uncleared ore brought in was about 2,700 lbs., of which perhaps 3 or 400 lbs. may have been strictly foreign matter or laterite clays, but in some of the masses it required a good deal of trouble to get rid of the clay which formed thin seams or partings in the masses of ore, and which to separate entirely from some of the smaller lumps, required a good deal of abrasion and loss. With more care and leisure which I could not at the time readily afford, I have no doubt I might have obtained from 1,800 to 2,000 lbs., instead of as now only 1,000 to 1,200 lbs. of pure Graphite from the crude collection of 2,700 lbs.

" The hire for digging the above 2,700 lbs. crude ore was about 3 Rupees, the carriage by men to Trevandrum 12 Rupees or total 15 Rupees or at the rate of about ½ Rupee per 100 lbs., or for the

cleared Graphite, which I have prepared for shipment, at the rate of 1 Rupee per 100 lbs., but as I have above noticed I have little doubt that with ease it may be put down at Trevandrum which is within 1½ mile of the sea at ¾ Rupee per 100 lbs., without including any duty that the Travancore Government may hereafter consider it advisable to impose.

" From the smaller fragments of the Graphite I have by pounding it and washing the powder in water endeavoured to separate the clays, and I believe I have succeeded to a considerable extent, and I shall also prepare for dispatch 1 or 2 cwts. of this powder.

" I beg to forward a few coarsely made pencils prepared from the Graphite by a common peon, which would seem to prove the good quality of the material. I have prepared boxes to hold about 200 lbs. each, and the Government may perhaps approve of its being dispatched by sea from Cochin to England, and may approve of instructions being sent to the Collector of Malabar or Master Attendant at Cochin, to make arrangements for its shipment.

Government Horticultural Garden, Ootacamund.

For some years, I have read the Reports of this Government Institution with much pleasure, although I had not seen Mr. McIvor or his Garden ; but this year, my forest duties necessitating my proceeding to the Neilgherry Hills, I delayed forwarding the remarks called for, until I had an opportunity of ascertaining by inspection, and noting in some detail, " The present condition, resources and prospects of the Institution."

Ten years have elapsed since the Marquis of Tweeddale originated the scheme of this Garden, and the Court of Directors selected (on the recommendation I believe of Dr. Royle and Sir Wm. Hooker) the present Superintendent, who is eminently qualified by early training at the Royal Gardens, Kew, for carrying out the objects of the Institution.

The earlier stages of the Garden's existence have passed, and I need not perhaps allude to the great difficulties to be overcome

in commencing a Garden on these Mountains with a scanty income of 100 rupees per mensem, and the experience to be gained before exotics from various lands could be successfully introduced. I will, however, observe that the present condition of the Garden is very creditable to Mr. McIvor, who has labored by himself from the beginning without the aid of professional advice, and although much remains to be done, yet on making inquiry, I find it generally admitted by visitors that great progress has been made during the past year.

In the upper part, the borders and beds have been well planned and arranged, and have a neat and trim appearance. The view from the higher terraces is romantic, and from them only can the general plan be well seen and understood. On the grassy banks along the sides of the main walk, are clumps of showy flowers, and scattered through the ground are fine standard *Acaciæ*, *Eucalipti*, *Coniferæ*, *Psoraleæ*, *Swainsoniæ*, *Pultenæ*, *Humeæ*, *Hakeæ*, *&c.* Excepting a few specimens of *Mahonia Laschenaulta*, *Rhododendron Arboreum*, *Sapota Elengoides*, *Myrtus tomentosa*, *Ilex Wightiana and Viburnum acuminatum*; all the rest of the trees in the Garden seem to be introduced.

The lower part of the Garden is not in good order. It was originally a swamp, and suffers from frost in clear winter nights; the cold air formed on the slopes of the Mountains, rolls down into the valley and envelopes the herbage, blighting many tender plants. It is now protected from the high winds by rows of Australian trees, and there is a prospect of Mr. McIvor devoting his energies to it as soon as the Conservatory is finished. As Dahlias and many other plants which are not hurt on the upper slopes are killed by the frosts below, and as this evil cannot be entirely averted, it is proposed to make this part a grassy lawn for exhibitions of Native produce, with an avenue of 50 feet in breadth leading from the gate to the Conservatory.

General Results.—I have great pleasure in observing that the introduction of the seeds obtained through Government from Saharunpore, Darjeeling, China, Australia and the Cape has been most

satisfactory. A very considerable number of Timber and Forest trees, Shrubs and Herbaceous plants have been secured to the country, and thrive remarkably well, which alone renders the efforts of Mr. McIvor of great importance, especially as the seeds are sufficient for abundant distribution.

TIMBER TREES.—Amongst the Timber trees are the Blue Gum tree, the Deodar and the Patagonian Pine, perhaps I may add the Turkey Oak, Turkey Box and the Irish Yew, these latter are still of small size. The European Pines *(Larix and Abies)* have not answered well. On the other hand, the *Acacia Rubusta* of Australia is in such abundance as to stamp a peculiar feature in the scenery, which is entirely wanting in the drawings of Ootacamund (Colonel McKurdy's) printed 15 years ago.

FRUIT TREES.—The best varieties of English Apples and Pears are cultivated. Figs and Vines grow well. Also Oranges and Lemons—these latter succeed remarkably at the branch Garden "Kulhutty" which I visited and found the following trees bearing fruit,—Natal Plum, Newton Pippin, Malta Orange, St. Michael's Orange, Spanish Citron and Ischia Figs. Numerous grafts and seedlings have been sent to various parts of the country, as to Ramandroog in Bellary, Koodramooka in South Canara, and the Baba Booden Hills, Mysore. A complete set of Fruit Trees is about to be supplied to the Bangalore Garden, from which by reason of its central position and the cheaper carriage, I expect there will be a most abundant distribution of valuable productions radiating over the country.

MEDICINAL PRODUCTS.—The *Digitalis purpurea* (Fox glove) is grown for the supply of the Medical Store on annual indent; the Spearmint and Peppermint thrive remarkably in the Upper Garden and could be supplied in large quantity. Two large and healthy Jalap Plants are in great luxuriance; these Mr. McIvor proposes to remove to the Subsidiary Garden at Kulhutty with the hope of being able to propagate them extensively. This would be a great result. Two Cinchonaceous plants from Patagonia received from Mr. Lobb under the name of *Cinchona micrantha*, and

a small specimen of the *Cephäelis Ipecacuanha* are in the Garden, but they appear to suffer from the misty atmosphere. It is of the utmost consequence, that the introduction of the true Cinchonas should be fairly tried on the Neilgherries, and Mr. McIvor is well able to conduct the experiment. The drugs have been hitherto delivered free of charge, it seems to me that the cost of productions should be charged to the Medical Department, as this Institution has always been hampered for want of Funds.

BUILDINGS.—The Conservatory sanctioned at an estimated cost of Rupees 4,300 is far advanced towards completion, and will unquestionably be a great acquisition to the Garden. The structure was designed by Capt. Francis, Engineers, and approved by Mr. McIvor. The delay in its erection has been unavoidable, as reported by the Committee.

The seed-house lately suffered serious damage from fire and requires to be rebuilt. The site selected by Mr. McIvor is close to his Bungalow in a dry and convenient situation. This is a most important department of the Garden, from which seeds ripe and correctly named can be at all times distributed to various parts of the country. An alteration of this old seed-house so as to admit four or even six apprentices and sleeping quarters would be highly advantageous. A plan and estimate amounting to Rupees 1,650 has been forwarded* I understand by the Committee for sanction. This provides I believe for flues and close-fitting drawers, dryness being essential for the preservation of seeds.

* 6th July 1857.

SEEDS.—Mr. McIvor has made some important attempts at growing European vegetable seeds in India. Experimental samples of many kinds have been sent by him to Dr. Wight, and these are now under trial in the Garden of the Horticultural Society, London. If a favorable opinion be given, Southern India will no longer be dependent for kitchen garden seeds upon England, France or the Cape. So far as the seeds have been tested in this country the result has been favorable, especially the Lettuce, Carrots, &c. It has occurred to me that the Soldiers' Gardens of this Presidency should be supplied with Neilgherry and English seed in equal

quantity, and from the Reports received a few deductions may be drawn as to their comparative value.

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FINANCES.—The statement in future years may be improved by entering more into detail, and showing clearly the various items of receipt and expenditure, as for instance, the expenses of the Kulhutty Nursery and the Horse Allowance for visiting it, and the monthly outlay for labour. These appear at present under the head of "Working expenditure." The accounts should be audited by one or more of the Garden Committee.

In the previous report of the Garden, it was stated that the total outlay was about rupees 200 per mensem, but this year, I am happy to observe that the income has risen to nearly rupees 400 per mensem, being 100 rupees of Government allowance and about 300 rupees by sales; this shows an encouraging state of progress in a financial point of view, and has allowed Mr. McIvor to carry out considerable improvements in the Upper Garden.

PRICES.—The extreme facility with which many trees and plants may be propagated, and the comparative mildness of the winter, during which season many exotics continue to grow from cuttings (if planted out of the reach of frost) would warrant their sale at a reduced rate.

It is the object of Government to introduce as many species as possible at the lowest cost, consistent with the repayment to the garden of the actual expenses of introduction and propagation, with a sufficient surplus to meet the repairs of buildings, &c. and to admit of the extension of operations.

A strong feeling generally prevails that the prices named in the Catalogue are high, and I cannot doubt, but that advantage would arise from lowering them (as formerly urged by me). I have discussed this point with Mr. McIvor, who naturally adduces the fact that the income of the Garden depends largely upon sales; I am disposed to meet his objection by recommending that Government should sanction the debit of the actual cost of drugs supplied to the Medical Board, and of trees to the Department Public

Works. Certain trees, for instance, might be supplied to the roads at one anna each, or rupees five per hundred, and the cooly hire for collecting and preparing the drugs should, I think, be charged to the Medical Department; this Mr. McIvor states would allow of a reduction of 25 per cent.

The Acacia Robusta, Weeping Willow, Cypress, Ivy, &c. are of very easy culture and could certainly be sold at a reduced rate. Fuchsias, Chrysanthemums, Geraniums, &c. &c. would be dear at English prices, but with fruit trees especially a low price is to be desired. Vines and Figs propagate readily from cuttings; Apples and Pears can be grafted during a great part of the year, and a cheaper rate would repay their cost. Plums, Peaches and Cherries are more difficult of propagation, and their price might reasonably be higher. On the whole, it appears to me that a continuance of the present rates will cause a partial failure of the object of the Institution and induce Residents to procure plants and seeds from England instead of availing themselves of the local Establishment, where the same plants are procurable.

In the weekly market at Ootacamund there is an increasing display of fine specimens of Garden produce. The proposal of establishing an Annual Exhibition of Vegetables, Fruits and Flowers is a good one. Government might contribute 100 rupees towards the expenses of this, on the condition that the Committee raise an equal sum from among the Residents.

Coonoor Nursery.—Before leaving the Neilgherry Hills, I visited the Coonoor Subsidiary Garden in company with Mr. McIvor. It is well sheltered and well watered, situated 1½ mile from Coonoor. Nine gardeners are employed, including the Maistry at the cost sanctioned of 50 Rupees per mensem. The Orange appears to grow here in as great perfection as at Malta or Canton, and when the Garden is in full operation will probably do away with the necessity of keeping up the Kulhutty Nursery which might be then sold with advantage. There would be three Gardens forming a graduated series in one line of road. Alpine, Subalpine, and Tropical, viz., Ootacamund, Coonoor, and Burliar.

Jack trees.
Nutmeg do.
Clove do.
Allspice do.
Cinnamon trees.
Cocoa do.
Vanilla creeper.
Peach trees.
Orange do.
Lime do.
Pumplemoss trees.
Grenadilla Vine.
Mangosteen.
Rose apple.
Loquat.
Pine apple.

The latter, indeed, is the private property of E. B. Thomas, Esq., Collector of Coimbatore, but from his zeal in Arboriculture, and great liberality to all applicants, its usefulness for disseminating Tropical products is almost as great as if it were public property. In the margin, I annex a list of the Fruit trees, Aromatic shrubs, &c. now cultivated in this rich but confined nook, in which the Cocoa tree, Nutmeg, Allspice, &c., have succeeded admirably, and from which it is the hope of Mr. Thomas, that they may be extensively spread over congenial climates, such as the Wynaad and other parts of Malabar.—*Memorandum on the Government Garden of Ootacamund* by H. CLEGHORN, *Supt. Botanical Gardens.*

Preservation of Timber.

The Permanent Way Company, 26 Great George Street, Westminster, are employing with success Dr. Boucherie's method of preserving timber. Solutions of preservative substances are introduced by the patent process into various kinds of timber, in such a way as to expel the fermentescible sap, and substitute matter less liable to undergo destructive changes. It has been found that sulphate of copper, dissolved in the proportion of at least $2\frac{1}{4}$ lbs. to 22 gallons of water, is the best preservative. It is said that white pine thus impregnated with sulphate of copper, placed in the ground as railway sleepers, or exposed to the action of the air, lasts longer than oak unprepared placed in the same situations. The Directors of the Chemin de Fer du Nord state, that Dr. Boucherie's process has produced most satisfactory results as regards sleepers when completely prepared. Those in use since 1846 were as good in 1855 as when laid down. The sleepers are Beech, Hornbeam, Birch, and Pine. The posts for the telegraphic wires prepared by this process, have also shown great durability. The process thus appears to impart durability to woods which are cheap and abundant.—*Edinburgh Philosophical Journal, April* 1857.

Height of the Himalayas.

It appears from a late survey made of the Himalaya range, by Colonel Waugh, that the Khanchinjinga, which has been hitherto supposed to be the highest summit, is in fact not so—a higher mountain having been discovered, situated between Katamandoo and Khanchinjinga. This last named is 28,156 feet above the level of the sea; but the new summit reaches the enormous height of 29,002 feet. It has been proposed to call this Mount Everest, after a former surveyor-general of India.—*Ibid.*

Effects of the sting of Scorpions.

Mr. Westwood communicated an extract from a letter of a correspondent in India relative to the effects of a sting of a Scorpion. It is described as very severe, resembling the pain of a dozen wasp stings concentrated in the same spot. The finger began to swell, and the whole arm pained excessively, with a feeling of sickness. Ipecacuanha powder was applied, in the form of a paste, to the sting, and brandy and water taken liberally. A native doctor, on being sent for, after rubbing the arm, at length suggested a native remedy, namely a small pan of live charcoal, upon which were occasionally, as they melted, thrown pieces of wax, the smoke from which was allowed to arise over the wound, and which allayed the pain to such a degree that in about an hour and a half the patient was able to smoke. The stung finger was still insensible to the touch and very much swollen, the arm cold as ice, although it had been rubbed for two hours, whilst the sound hand and arm were hot. More brandy and water, with cigars were tried. The patient fell into a long sleep, and awoke next morning with but slight remains of the pain of the sting.—*Zoologist,* 5642.

How to get rid of Musquitos.

Mr. Fortune exhibited samples of the article known as "musquito tobacco" in China. He stated the composition to be the sawdust of pine and juniper, with the powdered roots of a species of Artemisia and a small quantity of Arsenic. These are formed into

a paste, and coated over slender sticks, of about two feet in length, which are burnt as candles and never fail in driving the musquitos from the room. Mr. Fortune added that the Artemisia, which is a species growing wild on the Chinese hills, is employed to fumigate bee-hives, in order to take the honey without killing the bees. —*Zoologist*, 5644.

The Mulberry-tree with reference to the culture of Silk.

The art of rearing silk worms for the sake of the thread spun by them had its origin we believe in China. About the 6th century it was introduced into Greece, from whence several centuries afterwards it was carried into Sicily and found its way thence into Italy and Europe. It is now carried on very successfully in many countries but particularly in the South of France, Italy and Spain. East Indian silk comes chiefly from Bengal and is inferior in quality to both China and Europe produce. It is also made to some extent in Mysore, Cuddapah, Pondicherry and various parts of the Dekhan.

As the mulberry tree plays an important part in the process of silk manufacture, the following extract of a letter from the correspondent of the *Times*, dated Paris 22d June, 1857, is inserted as bearing on the conditions under which the culture of silk is most successfully prosecuted, and pointing to the advantage which might attend an experiment on some of the more elevated hill-tracts of India, as the Nilagiris, Baba Booden, Pulney, Bella Rungan and other ranges, where we believe it has never been tried.

"The silk crop is sufficiently advanced in the south of France for the growers to be certain that it will be more productive than last year. M. Dumas, who was commissioned by the Academy of Sciences to investigate the causes of the disease which destroyed so many silkworms last year, and to discover a means of removing it, proceeded to Alais last month for the purpose of minutely examining the state of matters. He has since communicated to the Academy the results of his observations. M. Dumas has discovered that all the reports relative to the leaves of the mulberry trees being diseased are unfounded. The leaves throughout the south this year are splendid, and where the eggs are sound the results have

been most satisfactory. M. Dumas states that the eggs produced in France, Spain, Piedmont, and Lombardy have in general failed, as well as many of those imported from the East, but it is suspected that the latter were produced in infected countries and sent to the East to be sold as if produced there. The eggs from Adrianople, Lebanon, and the Roman States were remarkably successful. Whenever M. Dumas could ascertain the origin of the sound eggs he universally found that they were produced in a mountainous country—that is, in pure air frequently renewed, and that the silkworms were fed on mulberry trees grown in elevated situations. One fact demonstrates what influence an elevated situation exercises on the health of the silkworm. M. Dumas found an intelligent breeder of silkworms, named Etienne, living on the small mountain of St. Germain, near Alais. Four years since he used eggs brought from Italy, and his success was complete. While all the silkworms bred in the low grounds died, he again succeeded, and even last year he produced a quantity of eggs sufficient for himself and for several other breeders. His success and that of the other breeders who made use of his eggs was so great that at this moment the entire country is astonished at it. M. Dumas says, in conclusion, that this year the breeders have tried every description of egg and every system. They were favoured by admirable spring weather and faultless mulberry leaves. It may be expected, therefore, that next year, if the weather should prove favourable, the experience now gained will enable the breeders to resume the course of their ancient prosperity."

The Volvox Globator.

In illustration of Mr. Bidie's paper in the present No. on the connection between the animal and the plant, we observe by recent No. of the Journal of the Microscopical Society that the well known animalcule—the *Volvox globator*—which has always hitherto been classed among the INFUSORIA is now proved to belong to the Vegetable kingdom.

In fact the limit between these two great divisions of organised forms appears to be indefinable. It has certainly not yet been discovered although many attempts have been to prescribe the exact boundary that separates them.

The earlier physiologists considered that such a limit was obtained by the presence or absence in the organism of a power of

spontaneous *motion* or more properly *locomotion.* But this was soon seen to be insufficient for most of the *Polypes* and some of the *Echinodermata;* all *Cirripedes;* and even some of the higher orders—the *Serpula* among ARTICULATA and the Oyster among MOLLUSCS are fixed to the rocks on which they grow.

On the other hand the *Spores* of many ALGŒ is of *Vaucheria* and of the *Sponges* have a very rapid locomotion.

The next distinction attempted to be drawn was taken from the mode of deriving nourishment, " plants" it was said " absorbing " nutriment by means of fibres at the lower extremity of the body, " animals by an opening (or mouth) at the upper end, conducting " to a capacious sac" (or stomach.)

But the *Gregarina*, a genus of microscopic parasites infesting gregariously the intestinal canals of insects, worms, &c. and several of the free INFUSORIA have neither mouth nor stomach and there is no stomach in *Cestoidea* one of the larger ENTOZOA. They are supposed to derive nutriment by absorption through the skin.

A third characteristic was supposed to have been found in the faculty possessed by plants of exhaling oxygen whilst animals expire carbonic acid. But here too the distinction fails; some of the free moving *Polygastria* eliminate pure oxygen in one stage of their existence while *Mushrooms* and *Sponges* have been found to give out pure carbonic acid gas.

Another chemical distinction it was thought had been discovered in the quaternary composition of animals which are resolvable into carbon, oxygen, hydrogen and nitrogen, whereas owing to the absence of the last mentioned element, the constitution of plants is ternary. *Cellulose* indeed is a binary compound of carbon and hydrogen only. But neither does this definition hold. Nitrogen is found in *Algœ*, *Fungi* and most cryptogamous plants. And on the other hand, the mantle of *Frustulia* a mouthless *Polygastria* and the thick cellular coat of *Ascidia* are binary compounds. Mr. Bidie has shown that there is reason to suppose the same binary constitution is not unknown among the highest order of animal existence, in the brain of MAMMALIA.

Some writers have maintained that the green coloring fluid which circulates round the cells of plants under the name of *Chlorophyll* was peculiar to vegetable productions only, but it occurs likewise in green *Planariæ* and in fresh water *Polypes*. With more reason the presence of starch has been thought to indicate a vegetable origin. But the test is not infallible. Others have supposed the power of continuing their race by voluntary division to be a distinctive function of the lower order of animals endowed with locomotion. But red snow and the yeast plant (*Torula*) are propagated by spontaneous fission and in many of the simple ALGŒ the cells elongate and divide themselves to form new individuals.

Hence it appears that a line of demarcation between these two great divisions of created existence has still to be discovered. Nay some have asserted the existence of organised bodies in an animal state at one period of their lives and in a vegetable one afterwards. This view, first started by Bory de St. Vincent, has more recently been revived by Kützing who gives an elaborate description in his work on the ALGŒ of an organism which he calls the *Ulothrix Zonara*, the young of what are propagated in the form of minute animalculæ which he declares he has detected in the cells of the plant and which afterwards become vegetable threads or lines and give out a new series, of animal offspring! The views of the most recent writers on the particular example cited below appear however to be still divided. In a recent work of that most distinguished of living physiologists, Professor Owen,* the *Vŏlvox globator* retains its place among the *Polygastria* at the lowest extremity of animal life, whilst the following extract shows that, more careful observations are considered to have established its place among the ALGŒ in the vegetable kingdom.

" In a paper cently read before the Academy of Sciences in Paris, Professor COHN states that his own observations on the *Volvocineæ* have convinced him that the members of that family must be regarded as belonging to the vegetable kingdom, and that the *Volvox globator* in particular, is properly placed among the ALGŒ. In this singular plant, as well as in *Eudorina, Gonium. Stephanosph*

* Lectures on Animals without Vertebræ, 1855.

æra, and the other *Volvocineæ*, each spherurle is, propely speaking, not so much an individual as an association or family of individuals a sort of vegetable polypary."

"The globe of *Volvox* is formed at its periphery of an infinitude of very minute hexagonal cells attached to each other in the same way as are the elements of an epidermic tissue. Each of the cells is furnished with two motile cilia and may be compared with a *Chlamydococcus*. The green endochrome is suspended as it were, in the cavity, being connected with the wall only by means of filiform processes.

"Like all the Algœ, the *Volvocineæ* present two distinct modes of reproduction; but up to the present time naturalists have been acquainted with only one of these, consisting in the repeated segmentation of the constituent cells, and resembling the fissiparity of *Chlamydococcus* and *Gonium*, or that of most of the *Palmellaceæ*.

"The second mode of reproduction of *Volvox* requires a sexual conjunction and is not observed indifferently in all individuals. The spherules endowed with the sexual function, are distinguished by their volume and the more considerable number of their component utricles ; they are generally monœcious that is to say they enclose at the same time male and female cells although the majority of their contents are neuter. The female cells soon exceed their neighbours in size, assume a deeper green colour, and become elongated like a matrass towards the centre of the *Volvox*. The endochrome of these cells does not undergo fission. In the other cells on the contrary, which acquire the size and form of the female cells, the green plasma may be seen to divide symmetrically into an infinity of very minute particles or linear corpuscles, associated into discoid bundles. These are furnished with vibratile cilia, and oscillate, at first slowly in their prism, but the movement soon becomes more active, and the bundles speedily break up into their constituent elements. The free corpuscles are very agile, and it is impossible to regard them as anything but true spermatozoids ; they are linear and thickened at the posterior extremity : two long cilia are placed behind their middle, and the rostrum which is curved like the neck of a swan possesses sufficient con-

tractibility to execute the most varied movements. These spermatozoids so soon as they are able to disperse themselves in the cavity of the *Volvox*, quickly crowd around the female cells into which they eventually penetrate; arrived there, they attach themselves by the beak to the plastic globule, destined in each cell to form a spore, and with which they are gradually incorporated. Fecundation having been thus effected, the reproductive globule becomes enveloped successively by an integument exhibiting conical pointed eminences and by an interior smooth membrane; the *chlorophyll* which it contained is now replaced by starch grains and a red or orange coloured oil. This is the condition of the spore at maturity and occasionally forty of these bodies may be counted in a single globe of *Volvox*. The germination of these reproductive bodies has not yet been observed, so that their history cannot be regarded as complete: but from analogy it may, in the meanwhile, be assumed that they germinate in the same way as do the spores of *Œdogonium Sphæroplea*, and other ALGŒ belonging to the same order. It may be maintained moreover, as certain that the *Sphærosira volvox*, Ehr., is nothing else than a monœcious *Volvox globator;* that his *Volvox stellatus* is also *V. globator*, observed at the time when it is filled with stellate spores, and, lastly, that the *V. aureus* of the same author differs from the other forms of the same species, simply in the smooth [and coloured] condition of the spores."—*Journal Microscop. Society*, *Vol.* V, *page* 149, *No.* XIX *for* 1857.

It must be added that Professor COHN is by no means the first discoverer of the true nature of the *Volvocinæ*.

At the meeting of the Microscopic Society of London on the 26th May 1852 a paper on "the structure and development of *Volvox globator* and its relations to other unicellular plants" was read by Mr. GEORGE BUSK, F. R. S. followed by a copious Appendix in the Oct. of the same year. Between which Professor Williamson also submitted a paper on "the farther elucidation of the structure of *V. globator*" at the meeting of the 21st June. These papers which go into the subject at great length are of too technical a character to suit the purpose of this Journal.

NOTICES OF BOOKS.

Oriental.

SALAMAN AND ABSAL, *an Allegory translated from the Persian of Jami.* London, 1856, in 8vo. XVI. et 84 pages.

The *Journal Asiatique* for February and March 1857, No. 34, announces the publication of the above poem in English blank verse, and says of the translator :—

" He is a pupil of M'Cowel, the Editor of the *Grammaire pracrite de Vararuchi,* a favorite with men of letters generally and especially with the friends of Persian literature with the translation of which he occupies himself. We know that in the greater part of Persian Poems the narrative is interspersed with anecdotes intended to place in relief the opinions the author; but these do not detach themselves sufficiently from the original text, and a certain obscurity sometimes arises thereby. The author of the translation has remedied this inconvenience by putting the anecdotes into shorter verses, and by using italics so as to distinguish them entirely from the principal narrative and to permit the reader to pass them over, should he so choose, without losing the thread of the story. * * * * Jami was born at the commencement of the 15th century, and lived 81 years. He was already an old man, when he wrote *Salaman o Absal* and he complains in the introduction of his poem, " that his 2 eyes were no longer of any use to him, and that European spectacles had not given him four eyes"*

A new Persian grammar is announced by Mr. A. H. Bleeck under the title of a *A Concise Grammar of the Persian Language* (Quaritch). It is a small but useful work, and to the great majority of students, who do not pretend to acquire more than a fair knowledge of Persian, it will be found preferable to the large voluminous dictionary of Mirza Ibrahim and others. Mr. Bleeck has given a brief notice of Persian literature in the preface to his grammar, and a list of books which he recommends to the attention of beginners.

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* The translator by the substitution of one word for another has rendered the reading.

* * * " My two eyes see no more
Till by Feringhe glasses turned to four."

Natural History.

Flora Algeria.—M. Corson is continuing to publish his Flora of Algeria, and is about to take a 4th Botanical trip into that country. He proposes to examine the numerous cases of the so called desert of Sahara. On the mountains of Atlas at each journey species have been discovered which were supposed to be peculiar to Egypt or Arabic.—*Ed. Phil. Jour. April* 1857.

American Oology.—" We have in the press the first part of Dr. Brewer's great work on *American Oology.* It will include the rapacious birds, and perhaps the swallows. There will be five quarto plates to this part, all the figures taken in photograph, from the original eggs, and printed in colors. The result is extremely beautiful and accurate."—(*Letter from Dr. Bird, Smithsonian institute, Washington.*)—*Ed. Phil. Jour. April* 1857.

Mr. F. Moore communicated a paper ' *On the habits of some birds observed in the plains of N. W. India* in 1849,' by the Rev. T. Philipps, Baptist Missionary. The names of the birds described in this paper (sixty in number) had been determined by comparison with specimens in the Museum of the Hon. East India Company.

Mr. Moore read a paper containing descriptions of some new species of Lepidopterous insects from Northern India, characterized as follows :—*Pieris Nama,* E. Doubleday, M. S., *P. Seta,*, Moore ; *P. Sanaca,* Moore ; *P. Indra,* Moore ; *P. Durvasa,* Moore ; and *Papilio Janaka,* Moore.—D. W. M.

Miscellaneous.

Glimpses of Life and Manners in Persia, by Lady Sheil, London, 1857, in 8vo. (402 pages.)

This book is thus noticed in the *Journal Asiatique* for April—May 1857, and we have much pleasure in endorsing the reviewer's opinions upon it, who informs us that,—

" Lady Sheil accompanied her husband Colonel Sheil, during his embassy in Persia and passed 3 ½ years in the country, principally at Teheran ; she made once a voyage to Ispahan and passed a summer in the mountains of Mazenderan. An elegant accomplished lady, she took the trouble to learn to speak Persian, and she communicates to us, in an agreeable and unpretending manner, her observations on the manners and customs of the country, and on every thing that she had an opportunity of

seeing satisfactorily. The Colonel has added to his wife's Journal a series of detailed and very instructive notes on the ruins of ANI, on the Koords, the Turcomans, the Nestorians; on Khiva, on Affghanistan, on the silk manufactures of Persia, on the Persian army, on the Revenue of the country, and on the Nomadic tribes of whom he gives a nominal and numerical list. These notes have a real value, as Colonel Sheil knows Persia well; he has lived there for 21 years, as Military Instructor, Colonel of a Regiment and finally as Ambassador. It is a pity that he has not gone into more detail in these notes, especially those which refer to the Nomadic tribes, concerning whom we have still but little information, while their study is extremely interesting from many points of view.

After the same manner also the Vicountess Falkland has given to the world a selection from her Oriental observations, in the form of a book entitled *Chouchow; being selections from a Journal kept in India, Egypt, and Syria.* 2 vols. (Hunt and Blackett.) The name at first sight is not a very inviting one, but the book improves upon acquaintance and contains a narrative of many amusing scenes. Lady Falkland accompanied her husband (Lord Falkland) in 1848, when he was made Governor of Bombay, and the work under notice is a pleasant *precis* of her personal experiences in the East. It is not a volume demanding much attention, but at the same time, is pleasantly written and for light reading is attractive and interesting.

The list of new works for September, includes a work entitled,—*British India, its History, Topography, Government, Commerce, &c.* By R. M. MARTIN. 1 vol. imp. 8vo. cloth, price 21s.

Also a little volume on "India" generally, by Mr. Stocqueler, and entitled *India.* (Foolscap 8vo. boards, price 1s. 6d.)

Mrs. Young who is a great admirer of everything Indian has added to her oriental sketches a book entitled *The Moslem Noble: his land and people; with some notices of the Parsees or Ancient Persians.* (Saunder's and Ottley.) The *Athenæum* does not review it very favorably, and thinks it will add little to her reputation.

Another contribution to our knowledge of Mahomedan life and manners, appeared about the same time as Mrs. Young's book, en-

titled *Autobiography of Lutfullah, a Mahomedan gentleman; and his transactions with his fellow creatures; interspersed with remarks on the habits, customs, and character of the people with whom he had to deal. Edited by Edward B. Eastwick. (Smith, Elder and Co.)*

The promised " *Memoirs and letters of the late Colonel Armine J. H. Mountain, C. B.*, have at last appeared, edited by Mrs. Armine J. Mountain, his widow. To Military readers the memoirs will have a peculiar interest, as Colonel Mountain was for sometime Adjutant General of the Forces in India, and died at Futtyghur in January, 1854.

The Rev. J. C. Browne, Assistant Chaplain on the Bengal Establishment has written a small work on *Indian Infanticide.* It has been published in England, and is priced 10s. 6d.

Having had opportunities of consulting official and other documents not easily accessible to people generally, Mr. Browne says that he has been enabled to collect information of a valuable nature on this interesting subject.

The Library of the Society has been furnished by Government with a copy of the *Cyclopædia of India and Eastern Asia.* By Edward Balfour, L. R. C. S. E., Surgeon, Madras Army. It is issued in Nos. of 100 pages each. Four Nos. have already appeared, containing in all 2,755 words, which reach as far as C in the Alphabetical arrangement.

Such a work undertaken by one man, and one too engaged upon numerous other duties, however studious and diligent he may be, cannot but contain many imperfections. The author himself is aware of this, but having long felt the want of some portable book of reference on scientific and economic subjects connected with Eastern countries, he has liberally come forward with his services and has laid the foundation stone as it were of a work which is intended to supply that want. There is no question but that his long residence in India, his Scientific researches and his very variety of duties eminently fit him for a work of this character, which however imperfect and incomplete as a whole, will be of great utility, and prove a valuable aid to others who may wish to walk in

his footsteps. That there will be found such others willing to aid in the good work we feel assured.

As more consonant with the times though of less literary importance, there have been announced within the last month or two;

A new edition of *The Mission the Camp and the Zenana, by* Mrs. Colin MacKenzie, under the title of *Six years in India; Delhi the city of the great Mogul, with an account of the various tribes in Hindoostan, Hindoo, Sikhs Affghans, &c.*

Our Indian Army; a Military History of the British Empire in the East. By Captain Rafter.

Dacoitee in Excelsis; or the spoliation of Oude by the East India Company.

Whatever the aim may have been of the author of this last mentioned publication, whether to get up a diversion in favor of the Oude Ladies at home, or to stimulate attention to Indian affairs, he could not well have selected a subject more mal-apropos to the present time. Neither he nor his subject will attract much sympathy just now.

The several publications and pamphlets elicited in explanation of the present disastrous mutiny in Bengal are too numerous to mention.

PROCEEDINGS.

The Managing Committee of the Madras Literary Society *and Auxiliary of the Royal Asiatic Society, Thursday evening the* 13*th of August, and* 10*th of September,* 1857.

The Honorable Walter Elliot in the Chair.

The usual Financial Statement had been read, it was decided that the Funds were in after a satisfactory state, such as to allow of the Library being stocked with such Standard works on different subjects as in the opinion of the Committee were calculated to complete the different branches of Literature.

Several specimens of carved wood from Saharunpoor were laid on the table. Dr. Jamieson, the Superintendent of the Botanical Garden at that place, intended that they should have appeared in the Exhibition, together with specimens of the different kinds of Tea grown in the Himalayan Plantations. But the packages having been late in reaching Calcutta, and having been then forwarded in the Ship "Gustave" which took two months after leaving the Sand Heads to reach Madras, the articles did not arrive till long after the Exhibition had closed.

The specimens consisted of Platters, Pen Trays, &c., carved in the beautiful white wood of *Wrightia anti Dysenterica* or the darker timber of species of *Nauclea Doodia*, &c. The designs represent different kinds of foliage, and are generally elegant. Some of them are in considerable relief. The large Platters are sold for 3 Rupees, the Trays for 1 Rupee each, at the place of manufacture.

Mr. Elliot exhibited a series of microscopic drawings of Marine Animalculæ made by Mr. E. M. Wrench of the 12th Lancers, during his voyage from England in the "Gloriana," in the early part of the year.

Mr. E. read a short notice identifying such of the specimens as were depicted with sufficient clearness to exhibit their generic characters.

These were found to be, for the most part minute Crustaceans belonging to the division of Copepods, Milne Edwards, and principally to the Genera of *Pontia* and *Cyclops*.

An Amphipod Crustacean approaching nearly to the Genus *Vibilia* and found in the cavity of a *Diphya* was also conspicuously represented.

Besides these were one or two *Annelides*, minute *Beroes* a very small *Medusa* belonging to the Gerqonidæ, and several remarkable forms apparently of undescribed animals.

Although not represented with sufficient minuteness of detail to allow of more accurate identification, Mr. Wrench's drawings are executed with great spirit and appearance of truth. Mr. E. pro-

posed that a selection of them should be engraved for publication in the Journal, with a view of showing how large and interesting a field of discovery exists for persons provided with a Microscope, during long voyages. He also proposed in connection with the same subject, that an excellent Memoir on Animalculus and other organized bodies, which give a colour to the Sea, by Camille Dareste, should be re-published among the selections. It appeared originally in the Anneles des Sciences Naturelles, and has been translated for the Edinburgh *New Philosophical Journal.*

The subject was referred to the Committee of Papers.

The Committee have to acknowledge the receipt of the following Papers.

The Study of Living Languages, by Colonel A. Cotton.

Suggestions for Weights and Measures for India, by W. H. Bayley, Esq.

A plan for taking Stereoscopic Portraits with a common Camera, by Lieut. Paxton, *from Dr. Scott.*

The Oxymel Process in Photography, by J. Tawse, Esq.

DAILY

JUNE 1857.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1	29·704	88·0	77·9	102·3	82·2	?	0·009	Hazy
2	·706	88·6	77·4	103·5	81·8	w s w	....	Clear
3	·716	88·9	78·8	101 6	83·8	s	....	Hazy
4	·709	87 9	78·3	101·3	82·3	s w	....	do
5	·74·	87·1	78·5	97·9	81 6	s	....	Ovcst.
6				98·3	83 5	s by w	...	
7	·750	87·2	79·5	97 3	81 5	s by E	....	Clody.
8	·708	87 5	79 8	99 4	82·4	?	....	Hazy
9	·687	86·9	79 6	98·4	76·9	s	....	Clody.
10	·723	83 0	78·2	89 8	76·7	?	1·770	do
11	·740	82·8	78·2	94·2	78·6	w	0·325	do
12	·656	85·6	78·1	100·4	79·1	w s w	....	do
13				98·7	79·2	s w	....	
14	·691	81·7	76·9	86·9	79·6	w	·220	Ovcst.
15	·706	82·4	77·2	93·7	79 0	w	...	do
16	·673	83·6	76·2	94 7	79·0	w s w	...	do
17	·684	84·1	75 2	95·4	79·4	w	....	do
18	·707	85·0	76·1	98·1	78·8	w s w	....	Clody.
19	·694	86·1	76·9	100 3	81·1	w	·100	do
20				98·0	80·5	w s w	·056	
21	·666	85·4	76·4	99·7	80·5	w	·024	Ovcst.
22	·661	85·2	75 5	91·4	81·3	w by s	·034	do
23	·714	87.7	76·2	101·6	80·2	w s w	....	Clody.
24	·734	88·0	77·4	102 1	80 9	s w	....	Hazy
25	·731	88 8	77·3	102·9	83·8	w	....	do
26	·753	85·4	77·3	100·5	80·8	s w	·330	Clody.
27				100·9	80·3	w s w	....	
28	·736	84·5	76·3	95·2	82·0	w s w	·025	Ovcst
29	·733	86·7	74·9	102·1	80·3	w by s	·047	Clody.
30	·740	88·7	75 0	97·4	82·6	w		do
31								
Mean.	29·710	86·0	77·3	98·1	80·7		2·940 Sum	

JULY 1857.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1	29 723	88·1	75·7	103·2	81·6	s s w	....	Haz
2	·722	85 7	76·8	99 1	79·8	s s w	0·060	Clo
3	·694	87 2	76 9	102·9	81·3	s s w	....	do
4				102·8	81·5	?	·006	
5	·693	87·0	76·0	100·3	83·4	w by s	·039	Ove
6	·695	89·7	76·7	102 7	83·2	w s w	....	Clo
7	·718	86·6	77·4	99·4	81·0	s s w	....	do
8	·739	87 5	77·3	101·4	82 8	s w	·123	Haz
9	·747	87·1	77·5	101·1	82·2	s w	....	Ovc
10	·711	86·5	77·4	99 7	81·3	s s w	....	Clo
11				99·3	78 5	s s w	·003	
12	·704	85·7	77 0	100·2	80·9	w s w	·570	Clo
13	·713	·87 2	76 7	99 7	82 6	w s w	·010	do
14	·694	87·9	75 8	100·8	81·4	w s w	....	Haz
15	·670	87·7	76 0	98 3	82·6	w s w	....	Clo
16	·660	86·8	76·9	99 8	81·9	s w	...	Ovc
17	·674	86·7	77 3	99·0	81·2	s w	...	Clo
18				97 0	82 0	s by w	·010	
19	·720	86·7	78 0	98·6	81·8	s	....	Clo
20	·737	86·2	78·3	100·7	80·3	s s w	....	do
21	·750	83 8	77·4	95·1	77·8	s s w	·007	Ovc
22	·752	83·7	77·7	95 7	76·2	w s w	·006	Clo
23	·760	83 7	77·5	94·2	80·2	s w	·199	do
24	·766	84·7	78 0	97·5	79·1	s s w	·030	do
25				96·0	79 0	s	...	
26	·748	80.7	76 3	84·8	76·7	?	....	Ovc
27	·773	77·6	74·4	87·1	74·1	w	·890	do
28	·772	79·5	74·5	89·6	76 0	w s w	·172	do
29	·709	79·7	75·1	93·4	77 0	w s w	·021	do
30	·670	81·8	75·3	94·4	77·6	s w	·095	do
31	·707	81·6	75·2	91·1	77·6	w	·029	do
Mean.	29·719	85·1	76·6	97·6	80·1		2·270 Sum	

? This mark signifies that no Means can be

MEANS.

August 1857								September 1857.								
[Barometer] reduced to 32° Faht.	Thermometers. Means. Dry	Thermometers. Means. Wet	Thermometers. Max.	Thermometers. Min.	Wind.	Rain.	Remarks.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Thermometers. Means. Wet	Thermometers. Max.	Thermometers. Min.	Wind.	Rain.	Remarks.	Date.
[In]ches	°	°	°	°		Ins.		Inches	°	°	°	°		Ins.		
			96 4	78·1	w s w	0·122		29·798	85 9	78·0	95·9	82·2	s s E	....	Clody.	1
·764	83 5	77·1	95 3	79 1	w s w	·010	Ovcst.	·795	86·0	77·9	96·1	83·5	s by E	....	do	2
·802	84 8	77·9	97 9	80·2	s w	·232	Clody.	·785	86·9	77·3	98·4	82 7	s w	....	do	3
·774	85·1	77·6	97·7	80·1	s s w	....	do	·783	86·1	77 6	96·3	81·6	s s E	....	do	4
·767	85·2	77·5	97·9	80·0	s w	....	Ovcst.				96 0	81·0	s s E	...		5
·771	86·3	77·4	100·9	81·6	s w	....	Clody.	·766	86 6	77·4	99·7	81·4	s by w	....	do	6
·753	85·9	76 7	100·0	81·3	w s w	·060	do	·756	87·1	77·2	100·9	82 3	s w	....	do	7
			98·8	81·7	w s w	....		·779	87·0	76·6	101 1	83·0	s w	....	Ovcst.	8
·743	87·5	75·5	100·9	81·2	w s w	....	do	·768	87·0	75 9	99·6	83·0	s w	....	do	9
·719	87.8	73·9	100·0	80·7	w s w	....	do	·796	85·5	75·1	95·9	79 6	?	....	Hazy	10
·718	85·9	76·1	99·8	81·2	s w	....	Ovcst.	·824	85·6	76 7	94·8	80·8	s	....	do	11
·718	86·4	76·2	101·8	80·7	?	·010	Clody.				99 1	80·8	s s w	...		12
·709	85·5	77·0	99·8	80·1	s w	·050	do	·798	85 9	76·2	98·5	82 9	w by s	0·003	Clody.	13
·742	88·0	74.7	99·5	82·4	w by N	·192	Ovcst	·818	82·8	75·9	96·6	78·5	w s w	....	Ovcst.	14
			98 7	83·6	w by s	....		·828	82·3	76·1	88·9	79·5	w	·290	do	15
·713	89·0	74·7	101·3	83 9	?	....	do	·775	82·7	75·9	92.2	79·3	w s w	....	do	16
·708	87·5	75·4	100·1	82·4	w	....	Clody.	·729	82·0	75·3	89·9	78·6	w	·310	do	17
·737	84·9	75·7	95 9	81.6	w	...	Ovcst.	·738	84·6	75·5	97·2	81 2	w	·220	do	18
·741	86·7	75·8	101 0	82 6	s w	·130	do				98·0	79·7	w by s	..		19
·744	85·5	76·1	100·4	80·8	s w	...	Clody.	·824	83·5	77·1	92·7	79·0	s s w	....	do	20
·750	85·0	75·9	99·8	80·3	w N w	·012	Hazy	·872	83·5	77·8	92·8	80·2	?	·022	Clody.	21
			96 2	79·4	s w	·040		·895	83·1	78·5	91·2	80·7	s by E	....	Hazy	22
·789	84·4	76·4	97·6	81·0	w by s	.124	Clody.	·885	84·3	78 5	94·7	80·7	s s E	.080	do	23
·787	84·7	77·3	96·9	78 8	s by w	...	Clear	895	84·5	77 8	94·5	80·4	s	....	do	24
·776	85·5	76 9	101·0	79·4	w s w	....	Clody.	·900	85·3	78·5	96·5	81·2	s w	...	do	25
·775	86·7	76·2	99 5	82·3	w s w	...	Hazy				96·2	78·6	w s w	....		26
·807	85·7	76 4	97·8	81·2	w s w	...	Clody.	·851	84·4	76 9	96·2	79·0	w by s	....	Clody.	27
·809	86·3	76·2	101·1	80·2	w	·049	Hazy	·845	83·3	76·6	96 2	77 1	w s w	·135	Hazy	28
			101·5	82·3	w	....		·847	85·0	78·0	95·8	78·7	?	....	Clody.	29
·779	86·7	75·2	98·9	81 6	s s w	....	Clody.	·836	82·9	75·7	96·9	77·5	w by s	·340	do	30
·778	86 5	76·1	100·2	83·1	w s w	·015	do									31
·757	86·0	76·2	99·2	81·1		1·046 Sum		29·815	84·8	76·9	96·0	80·5		1·400 Sum		Mean.

[...]ken owing to the variable state of the Wind.

Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

HOURLY MEANS.

Gottingen Mean Time	Noon	1	2	3	4	5	6	7	8	9	10	11
Madras Mean Time	h m P. M. 4 41	h m 5 41	h m 6 41	h m 7 41	h m 8 41	h m 9 41	h m 10 41	h m 11 41	h m 12 41	h m 13 41	h m 14 41	h m 15 41
										*		*
Bar. at 32° Far. 1857	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
June	29·637	29·653	29·678	29·702	29·721	29·738	29·743	29·735	29·722	29·708	29·700	29·696
July	·648	·665	687	·712	·731	·749	·857	·747	·731	·722	·715	·713
Aug	·677	·690	·708	·736	·769	·787	·788	·780	·768	·760	·755	·756
Sep.	·745	·762	·783	·886	·827	·846	·848	·839	·826	·814	·806	·804
Dry Ther. 1857	°	°	°	°	°	°	°	°	°	°	°	°
June	90·3	88·5	85·6	84·3	83·7	83·3	82·9	82·5	81·9	81·6	81·3	80·8
July	88·7	86·9	84·9	83·6	83·0	82·4	81·8	81·3	81·0	80·6	80·3	79·9
Aug	89·7	87·2	85·0	83·9	83·5	83·0	82·5	82·1	81·9	81·6	81·3	80·9
Sep.	87·6	85·5	84·1	83·4	82·8	82·4	82·0	81·7	81·4	81·0	80·7	80·4
Wet Ther. 1857												
June	78·8	78·8	78·4	78·1	78·1	77·6	77·4	77·1	76·4	76·2	76·0	75·5
July	78·0	77·9	77·5	77·6	77·5	77·3	76·1	76·8	76·3	75·7	75·1	74·6
Aug	78·0	79·6	77·5	77·5	76·6	76·0	76·6	76·5	76·1	75·6	75·1	74·8
Sep.	78·1	78·0	77·8	77·8	77·7	77·7	77·4	77·3	76·8	76·5	76·3	76·0

Gottingen Mean Time	12	13	14	15	16	17	18	19	20	21	22	23	Means.
Madras Mean Time	h m 16 41	h m 17 41	h m 18 41	h m 19 41	h m 20 41	h m 21 41	h m 22 41	h m 23 41	h m 0 41	h m 1 41	h m 2 41	h m 3 41	
Bar. at 32° Far. 1857	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
June	29·702	29·717	29·736	29·752	29·65	29·765	29·753	29·729	29·706	29·682	29·659	29·644	29·710
July	·718	·127	·745	·758	·769	·769	·757	·733	710	·687	·666	·650	·719
Aug	·762	·775	·791	·810	·820	·817	·801	776	·746	·719	·694	·681	·757
Sep.	·813	·825	·845	·865	·877	·874	·858	·832	·800	·771	·752	·712	·815
Dry Ther. 1857	°	°	°	°	°	°	°	°		°	°	°	°
June	80·2	80·0	81·6	84·8	87·1	88·9	90·9	92·2	93·1	93·4	93·3	92·4	86·0
July	79·4	79·4	80·6	83·2	86·0	88·0	90·2	91·9	93·1	92·9	92·1	90·9	85·1
Aug	80·5	80·1	81·5	84·3	86·7	88·9	90·9	93·2	94·9	95·1	94·2	92·0	86·0
Sep.	80·1	79·8	80·7	82·9	85·2	87·7	89·7	91·3	91·6	91·6	91·0	89·5	84·8
Wet Ther. 1857													
June	75·0	74·7	75·2	76·3	77·1	77·6	77·9	78·2	78·5	78·8	78·8	78·8	77·3
July	74·2	73·9	74·4	75·1	76·1	76·5	77·1	77·4	77·8	78·3	78·4	77·9	76·6
Aug	74·4	73·6	74·0	75·0	75·2	75·5	75·8	76·4	77·1	77·6	78·1	78·1	76·2
Sep.	75·7	75·5	75·5	75·8	75·9	76·1	76·2	77·0	77·5	77·5	78·0	78·2	76·9

* The Numbers in these Columns are not observed but interpolated for the sake of obtaining the daily Means.

MADRAS OBSERVATORY,
1st October, 1857.

W. S. JACOB,
Hon'ble Company's Astronomer.

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Dhoba
Sirpoor
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Iree
Soompatam
Amunpully
Mutlagoodem
Kumulapetta
Devalamurry
Enchempully
Chennoor
Annavaram
Attiakota
Kota
Nuggram
Sironcha
Canlaiswaram
Mahadeopore

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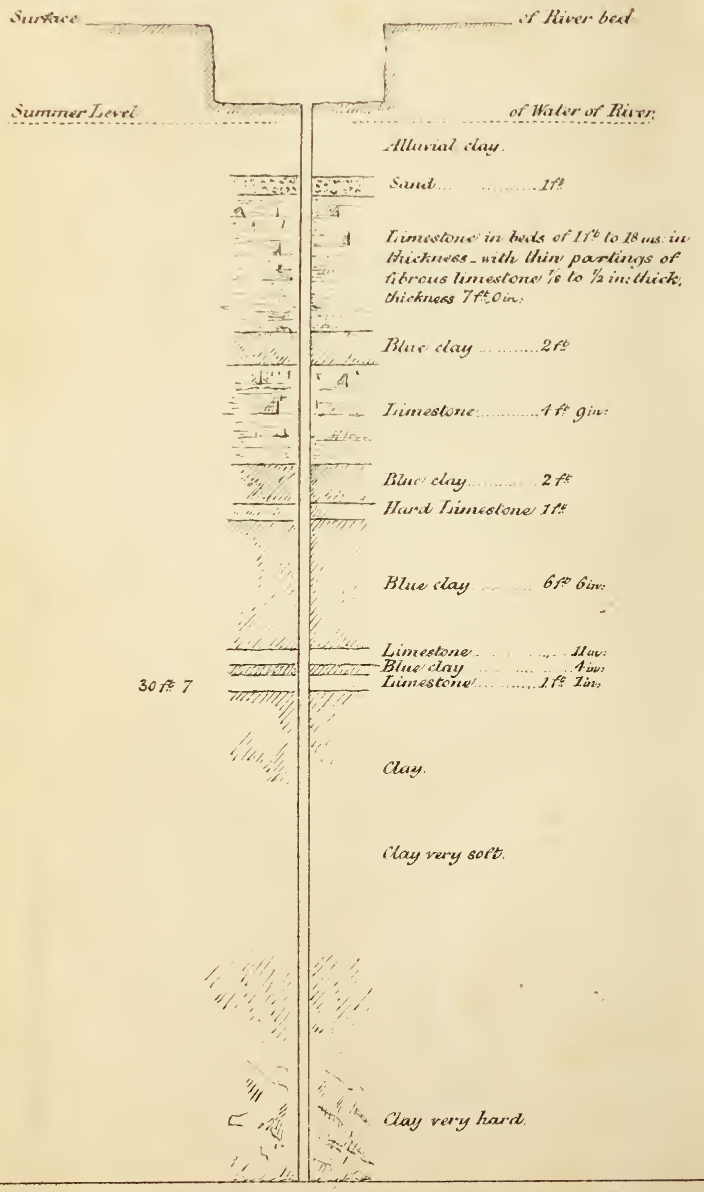
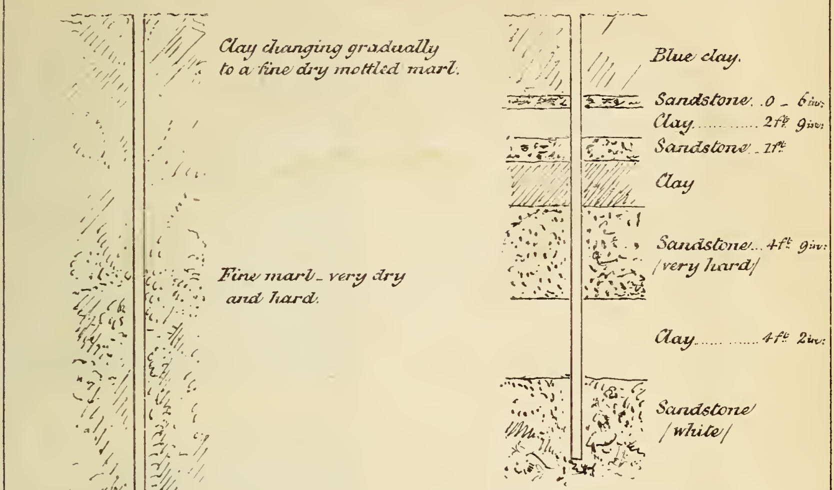
BRITISH MUSEUM

SECTION OF THE GROUND BENEATH THE SURFACE AT KOTA, IN THE CHENNOOR TALOOK, AS SHEWN BY BORING MADE IN APRIL & MAY 1857



Section &c. (continued)

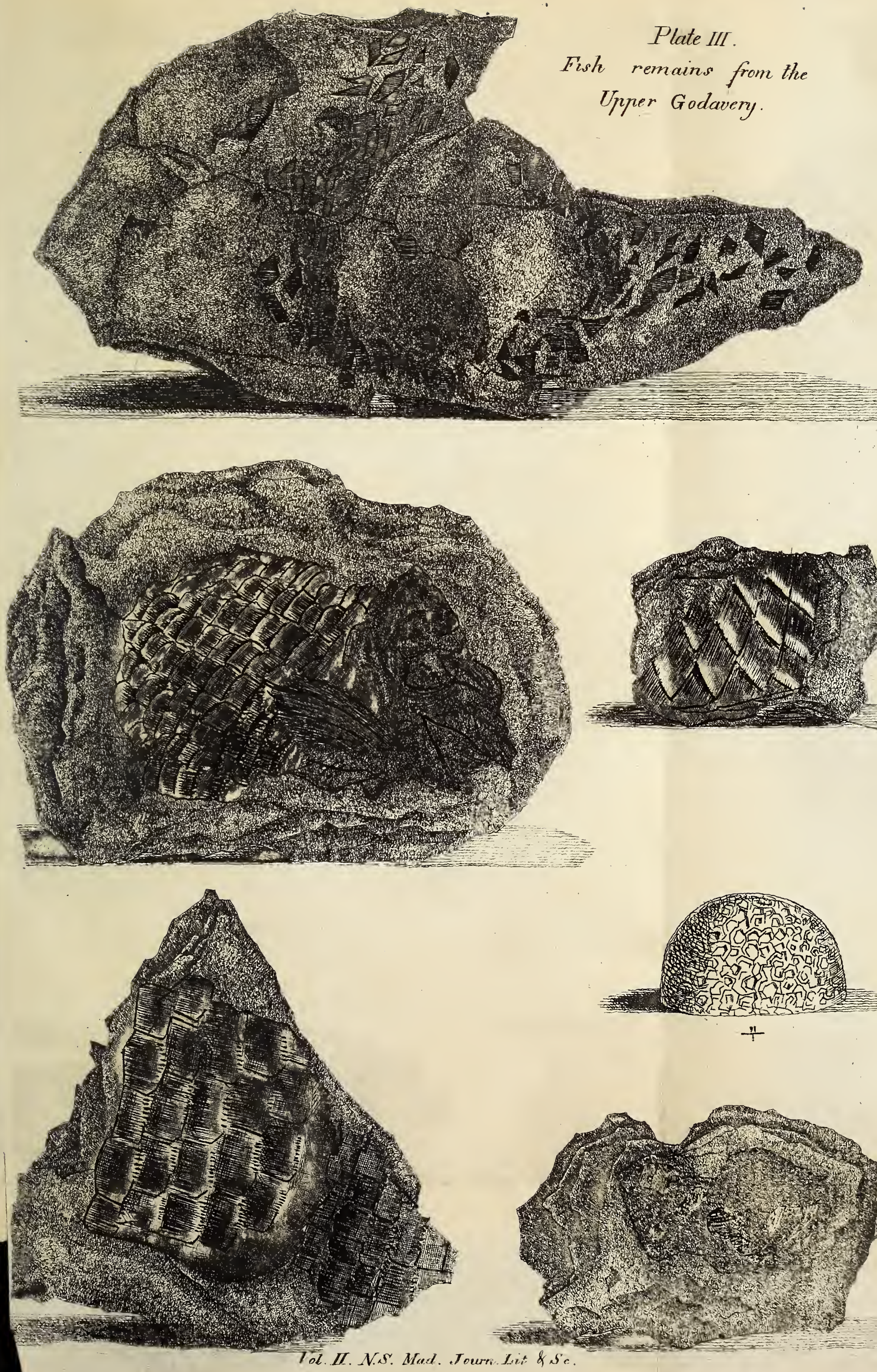


Total depth of Boring 145 ft. 8 ins.

TRANSFER BY H.R. CALDER & LITH: BY J. DUMPHY, GOVT LITH: PRESS, CENTL OFFICE P.W. FORT ST GEORGE.

NATURAL HISTORY

Plate III.
Fish remains from the Upper Godavery.



BRITISH MUSEUM

ON STONE BY J. SUARES AND LITH: BY J. DUMPHY. GOVt LITH PRESS CENTRAL OFFICE F. W. FORT St GEORGE

Tetracrypta cinnamomoides. *Gard: & Champ.*

From Kew Misc Vol. V. Pl: V.

BRITISH
NATURAL HISTORY

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Kokoona zeylanica Thw:

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